Royal Commission on the Future
of the Toronto Waterfront

East Bayfront and Port Industrial Area:

Pathways:
Towards an Ecosystem Approach

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Towards an Ecosystem Approach

A Report of Phases I and II of an Environmental Audit of
Toronto's East Bayfront and Port Industrial Area
Prepared for
The Royal Commission on the Future
of the Toronto Waterfront
by Suzanne Barrett and Joanna Kidd

April 1991

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Royal Commission on the Future of the Toronto Waterfront

CANADA

Ontario

Commission royale sur l'avenir du secteur riverain de Toronto

Commissioner
The Honourable David Crombie, P.C.

Executive Director and Counsel
Ronald L. Doering

Dear Colleague,

I am pleased to enclose a copy of the final report of the Environmental Audit of the East Bayfront/Port Industrial Area, *Pathways: Towards an Ecosystem Approach*. It summarizes the work, undertaken in two phases, that was conducted under the guidance of a steering committee comprising representatives from the federal, provincial, Metropolitan Toronto, and City of Toronto governments; the Public Advisory Committee for the Metropolitan Toronto Remedial Action Plan; the Metropolitan Toronto and Region Conservation Authority; the Labour Council of Metropolitan Toronto and York Region; and independent environmental experts. The report is a consensus of the steering committee's opinions and follows the Royal Commission's Publication No. 10, *Environment in Transition*, which covered the first phase of the Environmental Audit.

In its entirety, that audit assessed ecosystem health in the East Bayfront/Port Industrial Area, as a foundation for making decisions about its future. I welcome your comments on the steering committee's findings and recommendations, prior to submitting the Commission's final report to the Government of Canada and the Province of Ontario later this year.

Thank you for your interest in this important project.

Cordially,

Commissaire
L'honorable David Crombie, P.C.

Directeur exécutif et Conseiller juridique
Ronald L. Doering

Cher collègue,

J'ai le plaisir de vous envoyer un exemplaire du rapport final de l'examen environnemental de East Bayfront et du secteur portuaire industriel intitulé : *Voies multiples : vers une démarche axée sur l'écosystème*. Il s'agit d'un résumé du travail entrepris en deux phases et tenu sous la direction d'un comité d'organisation composé de représentants des gouvernements fédéral, provincial, de la communauté urbaine de Toronto et de la Ville de Toronto, du Public Advisory Committee for the Metro Toronto Remedial Action Plan, du Metropolitan Toronto and Region Conservation Authority, du Labour Council of Metropolitan Toronto and York Region et de spécialistes indépendants sur l'environnement. Le rapport reflète l'opinion générale du comité d'organisation et fait suite à la publication No 10 de la Commission royale, *Un milieu en transition*, qui traitait la première phase de l'examen environnemental.

L'examen en entier se veut une étude de la santé de l'écosystème de East Bayfront et du secteur portuaire industriel en vue de prendre les décisions sur leur avenir. Je serais heureux de recevoir vos commentaires sur les conclusions et les recommandations de l'examen avant de soumettre mon rapport final aux gouvernements du Canada et de la province d'Ontario plus tard cette année.

Je vous remercie de l'intérêt que vous portez à ce projet important et vous prie de recevoir, cher collègue, mes cordiales salutations.

David Crombie

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FOREWORD

Foreword

This report on the environmental audit of the East Bayfront and Port Industrial Area of the City of Toronto is the record of a pioneering effort in two important ways: first, in its use of an ecosystem approach and, second, in the way the audit team itself operated.

A comprehensive ecosystem approach is still rarely applied to a specific geographic area. That significant departure from the 'normal' method of carrying out research and planning was at once both simple and revolutionary: it involved asking different questions and, as a result, reached quite different conclusions than would otherwise have been the case.

The audit could serve as a model for applying an ecosystem analysis (although not always in the same depth and detail) to broader geographic areas. It could be used, for example, in evaluating relationships among the environmental, economic, and social conditions of the Greater Toronto Bioregion — which is a central task of this Commission's final year.

Second, the process that led to *Pathways* showed that it is possible to break out of the debilitating constraints of the fragmented bureaucratic system that now impedes the environmental regeneration we so desperately need.

Conventional wisdom holds that current government institutional arrangements are wholly inadequate to meet the challenge presented by modern environmental problems. The professional literature abounds with analyses which conclude that present systems of governance (and "the bureaucratic mind") cannot cope with today's global ecological crisis. Such literature urges radical restructuring of the entire system of government.

But perhaps there is another way. Consider the collaborative public process employed for the audit. The environmental audit team used the talents of 93 people: 53 public servants from four levels of government and their various agencies; 18 citizens from non-government organizations; seven from universities; three representing industry and labour; and 12 consultants in different fields.

They operated together, not to defend turf or impose on each other the views of the organizations from which they came, but to work in a task-oriented atmosphere, with a specific goal, limited by time, and — most of all — in ways that enabled them to escape the hierarchal command systems of the usual bureaucracy. They comprised a multi-disciplinary, multi-jurisdictional team working creatively to carry out a particular mandate.

The ecosystem approach that was the foundation of their efforts succeeds only to the extent that people break out of traditional bureaucratic structures. In that regard, the process by which the audit team operated may be a good example of what political scientist Robert Bartlett has called "subversive" or "worm-in-the-brain" strategies that could transform government administration from within.

The fruits of the team's collaboration were two important reports, of which this is the second, that were produced in less than 18 months. As valuable as the contents of this report are, the process of the audit team may, in the long term, be the most important pathway of all.

Ronald L. Doering

Executive Director and Counsel,
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ACKNOWLEDGEMENTS

Acknowledgements

The Environmental Audit of the East Bayfront/Port Industrial Area was undertaken by the Royal Commission on the Future of the Toronto Waterfront at the request of the federal and provincial governments. The work was guided by a steering committee composed of representatives from all four levels of government, the Metropolitan Toronto and Region Conservation Authority, the Labour Council of Metropolitan Toronto and York Region, and independent environmental experts. The authors of *Pathways* thank the members of the steering committee for their dedication and valuable advice throughout the process.

Pathways represents a synthesis of the research, analysis and recommendations made by twelve work groups during Phases I and II of the Environmental Audit of the East Bayfront/Port Industrial Area. Their work is available in technical papers from the Royal Commission (see list in the back of this report). We thank the work group members for their hard work, for meeting tight deadlines, and for their patience in discussing their findings with us. As well, this study received substantial support and assistance from the staff at the Royal Commission on the Future of the Toronto Waterfront, especially Gord Garland (research on employment), Sarah Kalff, (report production), and Jennifer Young (desktop publishing).

Finally, no acknowledgements are complete without noting that the authors take full responsibility for errors, omissions and misinterpretations. Although the environmental audit is now finished, we invite comments and feed-back as input to further discussions about the future of the East Bayfront/Port Industrial Area.

INTRODUCTION

Toronto's Port Industrial Area existed first as a dream, a vision of an area reclaimed from the marshes of Ashbridge's Bay to fulfil the needs of a rapidly growing industrial centre. The dream, grand in scale, was articulated in the 1912 plan developed by the fledgling Board of Toronto Harbour Commissioners (THC). It featured state-of-the-art docks, broad, tree-lined avenues, and shining modern factories. The Port Industrial Area was to be Toronto's flagship of industry, a nucleus of manufacturing that would bring industrial jobs and prosperity to the city and would be linked by ship, rail, and road to the outside world. The scope of the plan was immense: filling in the Ashbridge's Bay Marsh was itself considered one of the great engineering feats of its time. Symbolically, the building of the new Port Industrial Area was to bring Toronto into the twentieth century.

But the promise was not to be fulfilled. World War I and the Great Depression intervened, and few factories were built. Instead of becoming the industrial heart of Toronto, the Port Industrial Area became primarily a storage and distribution centre for bulk goods to meet many of the city's needs for coal and petroleum products, construction materials, foods, and waste recycling and disposal. Today, the East Bayfront/Port Industrial Area appears shabby, neglected, and underused. Many industries have gone or are about to leave, and some will have bequeathed a legacy of contaminated soils and groundwater. Although a sense of history remains in the dockwalls and bridges, factories and silos, little remains of the grandeur envisioned in the 1912 plan.

Nearly 80 years after the THC's plan to create the Port Industrial Area, the time is ripe for a new vision for this district. In recognition of this opportunity, the Royal Commission on the Future of the Toronto Waterfront, in its first interim report of August 1989, recommended "a complete evaluation of all THC lands ... including ... air, water, and soil quality ... before any major decisions are made on the future of the Port and the lands adjacent to it". On 17 October 1989, the Government of Ontario designated the East Bayfront/Port Industrial Area an area of Provincial Interest under the Planning Act (see Figure 1). This was done to protect the integrity of the Royal Commission's studies and to ensure that development that might foreclose future options would not occur while studies were going on and decisions were being made.

In November 1989, the environmental audit of the East Bayfront/Port Industrial Area was initiated by the Royal Commission, at the request of the governments of Canada and Ontario. Its purpose was to develop the best possible description and understanding of the environmental conditions of the study area and to explore the implications for future decision-making, remediation, and enhancement.

In conducting the environmental audit, an ecosystem approach was adopted to provide a framework for the research, analysis, and interpretation of information. This allowed us to investigate how the study area influences, and is influenced by, the areas outside it, how human actions are affecting the environment, and how environmental conditions may be affecting human health. It also allowed us to consider what measures might be necessary to achieve greater ecosystem integrity.

Although the environmental audit was led by the Royal Commission, it has been very much a collaborative undertaking, with the full co-operation of all levels of government, as well as many other parties. The steering committee is composed of representatives of the federal and provincial governments, Metropolitan Toronto and the City of Toronto, the Public Advisory Committee of the Remedial Action Plan, the Labour Council of Metropolitan Toronto and York Region, the Metropolitan Toronto and Region Conservation Authority (MTRCA), as well as independent environmental experts. The work groups include consultants, government staff, and representatives

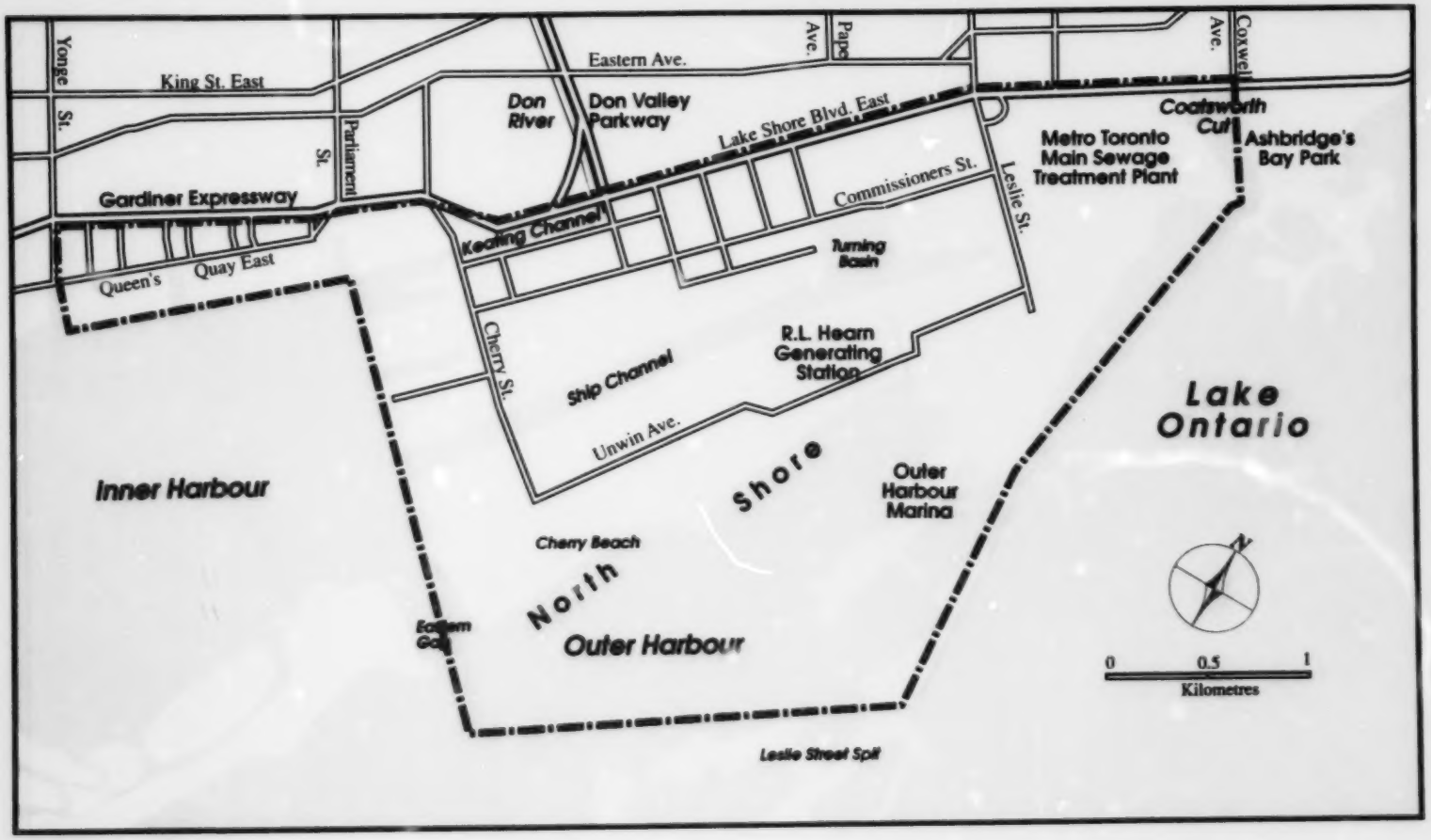


Figure 1 Study area

of the Toronto Harbour Commissioners, the Toronto Historical Board, the South East Toronto Industrial Awareness Organization, and a number of community and environmental associations. The wealth of experience and skills, and the multiplicity of viewpoints brought to the task by all those involved greatly enriched the audit.

Many members of the steering committee and work groups found that the environmental audit process provided a valuable opportunity for information exchange and co-operative work. For example, *Canada's Green Plan* includes the comment that "the Government of Canada sees this multi-governmental partnership as a model of the way in which it can work with other levels of government to achieve common objectives through the application of an ecosystem approach".

During Phase I of the audit, existing information was gathered on many aspects of the ecosystem, focussing primarily on the physical environment. The equally important economic and social conditions in the area were examined in less detail, for several reasons. First, the severe degradation in the physical environment has implications for human activities as well as for the health of wildlife. Second, ongoing studies by the Royal Commission are examining economic factors in more depth. And third, although people work and play in the East Bayfront/Port Industrial Area, it does not have residential communities.

Technical papers on the atmospheric environment, water, soils and groundwater, natural heritage, and built heritage formed the basis for the report on Phase I, *Environment in Transition*. Public hearings held by the Royal Commission in May 1990 stimulated valuable discussion and input for Phase II of the audit.

The Phase I work identified many gaps in our understanding of the environment of the East Bayfront/Port Industrial Area. During Phase II, further research was undertaken to address many of these gaps, taking into account that we had only a short time — from June to December 1990. Recognizing that further, more detailed research must be conducted but requires more time, the Phase II studies include recommendations for key research that should be continued in the future. The Phase II technical papers cover the atmospheric environment, built heritage, ecosystem health, hazardous materials, natural heritage, soils and groundwater, and water and sediments. These and the Phase I papers form the basis for this report, which concludes our environmental audit of Toronto's East Bayfront/Port Industrial Area.

The title, *Pathways*, is intended to convey several key themes of the audit. First, the entire environmental audit represents a search for knowledge and understanding of an area in transition. Land uses in the East Bayfront/Port Industrial Area are in a state of flux; there is a decline in port activities and loss of some industries, including coal and petroleum storage and distribution. In addition, our knowledge is growing as further research adds information to our picture of the area.

Second, one of the distinguishing characteristics of the ecosystem approach is its attempt to identify links, or pathways, among components of the ecosystem. For example, we have asked questions about:

- movement of contaminants into and out of the East Bayfront/Port Industrial Area;
- transfer of pollutants among the environmental media: air, soils, groundwater, surface water, and sediments;
- uptake of contaminants by biota;
- spatial links among habitats;
- temporal links with the industrial and natural heritage of the area.

Third, the East Bayfront/Port Industrial Area includes several important means of access. The northern boundary of the area is formed by the Gardiner/Lakeshore Cor-

Study area viewed from east to west

ridor and rail lines. Roadways and rail lines form a network through the area, intersecting with the ship channels and docks. There is a hidden maze of pipelines underground for moving petroleum products. Recreational access is furnished by the Martin Goodman Trail, the parkland at Cherry Beach, and the boating facilities of the Outer Harbour. These represent pathways and opportunities — existing and potential — for both the working and the recreational life of the city.

Fourth, the water/land interface and the semi-natural areas along the shoreline attract many forms of wildlife and provide links, albeit fractured ones, with the Don Valley, Leslie Street Spit, and the Toronto Islands. The north shore of the Outer Harbour is a crucial place on the migratory flyways of birds and butterflies, one of their few remaining stopovers along the Toronto waterfront.

Last, the environmental audit is part of a process to facilitate the recommendations made in *Watershed*, the Royal Commission's 1990 interim report: encouragement of green enterprise, increased parkland, consolidation of port and industrial activities, mixed-use development, and so on. In following these pathways, it is necessary to remediate unacceptable environmental conditions and seek ways to ensure that future developments contribute to greater ecosystem integrity.

Pathways represents thousands of hours of effort by more than 90 participants in both phases of the audit and has been a challenge to all those involved. It is the hope of the Royal Commission that the results of the environmental audit will be of assistance in wise planning for the future use of the East Bayfront/Port Industrial Area.

Chapter 1 of this report explores the ecosystem approach and the notion of ecosystem integrity. Chapter 2 examines the physical structures of the study area ecosystem — the habitats, both for humans and other organisms, and their historical development. Chapter 3 examines how the ecosystem functions — the ecological processes in

the area and the regional relationships — and includes a preliminary assessment of ecosystem health. Chapter 4 examines the way in which decisions are made about ecosystems, including issues of stewardship and accountability raised during the audit that affect ecosystem integrity. Finally, Chapter 5 presents some opportunities to overcome obstacles presented by environmental conditions and to improve ecosystem integrity in the area.

CHAPTER ONE

THE ECOSYSTEM APPROACH

Ecosystems

Simply put, an ecosystem consists of air, land, water, and living organisms, including humans, and the interactions among them. The concept of the ecosystem is a fundamental departure from the traditional view of the environment, which implies that the surrounding influences on an organism are separate from and external to it. In contrast, the ecosystem is a dynamic, interacting structure of which the organism is an integral part. The environment can be considered as a "house" — bricks and mortar — while the ecosystem is a "home". In fact, "eco" comes from the Greek word oikos, meaning household; "system" implies an interacting, interdependent complex.

Ecosystems may be understood at different scales. A small pond is an ecosystem, a complex network of plants and animals dependent on the pond's water, with energy and nutrients cycling through the system. The largest ecosystem, of course, is the biosphere. Planet Earth, suspended like a blue ball in the blackness of the universe, is almost self-contained, with its own atmosphere, water, minerals, soils, and life forms. Although the biosphere is often imagined as an independent and self-sufficient ecosystem, it is influenced by energy from the sun, as well as the gravitational forces of the sun, the moon, and other planets.

The smaller ecosystems within the biosphere are even less independent than the biosphere itself. Air, water, energy, and materials are cycled from one ecosystem to another. Seeds and spores of plants are carried great distances through the air or water, and birds, butterflies, and other animals can move thousands of kilometres during annual migration cycles. Human activities — forestry, agriculture, mining, energy use, and waste disposal among them — constantly arrange and rearrange ecosystem components. These interactions make it impossible to identify distinct boundaries of ecosystems.

In practice, ecosystems are defined to suit the purpose at hand: major ones like rainforests, deserts or the Great Lakes Basin, and smaller ones, such as individual watersheds, ponds or woods, within the major ones.

A healthy ecosystem has integrity, or the ability to maintain its organization and functions. Some of the factors that contribute to integrity are the ecosystem's resilience (the ability to cope with stress), productivity, vigour, balance, and harmony. The Royal Commission's report, *Watershed*, used the following analogy:

> A healthy ecosystem is like a house of cards: carefully constructed and balanced, the cards support one another. If too many stresses are placed on it, the effect on the ecosystem is like that of removing too many cards from the house: the entire thing collapses.

Scientists have coined a term for this collapse — "ecosystem distress syndrome". One of the best examples of this was found in Lake Erie in the 1950s, when the phosphorus levels rose so high that the ecosystem's defence mechanisms — its adaptability and resilience — were overwhelmed, much as human immune systems might be by disease. The result was excessive growth of algae that altered the food web, leading to a loss of valuable invertebrate life and the collapse of the once-vibrant commercial fishery.

By their very nature, ecosystems are dynamic and evolving, becoming increasingly complex and integrated. Left undisturbed over time, ponds become bogs, lakes dry up, fields become forests. In part, this evolutionary characteristic makes it difficult to assess the health of an ecosystem on a "snapshot" basis.

One of the major ecosystems in North America is the Great Lakes Basin, which covers 521,730 square kilometres (201,460 square miles). Within it lie the five Great Lakes, plus more than 80,000 smaller ones,

and many thousands of rivers and streams. The Great Lakes Basin supports more than 35 million people who are linked by their common dependence on the air and water circulating through the ecosystem, and who consume its fish, game, and farm produce.

Within the drainage basin of each Great Lake there are several smaller ecosystems, such as the Greater Toronto Bioregion — the area bounded by the Niagara Escarpment on the west, the Oak Ridges Moraine on the north and east, and Lake Ontario on the south. (For more on the Greater Toronto Bioregion, see the Royal Commission's second interim report, *Watershed*.) There are even smaller ecosystems based on individual watersheds, like the Don Valley watershed. All these units are defined on the basis of natural processes and features, and it is logical to attempt to study and manage them using an ecosystem approach.

By contrast, the East Bayfront/Port Industrial Area, the study area for the environmental audit, was defined, for policy reasons, without reference to ecological functions. The entire area was created by filling in an estuarine wetland at the mouth of the Don River. It consists of a narrow strip of waterfront (the East Bayfront) and a large port/industrial complex (the Port Industrial Area), with boat slips and channels, an artificial rivermouth (the Keating Channel), vacant lots, a semi-wild natural area along the shore, and the waters of the Outer Harbour. It is positioned at the interface between the Don watershed and Lake Ontario and is strongly influenced by ecological processes within the Greater Toronto Bioregion and beyond.

Using the Ecosystem Approach

Although the East Bayfront/Port Industrial Area is perhaps better understood as part of a larger ecosystem (the Don watershed, for example), it is useful to take an ecosystem

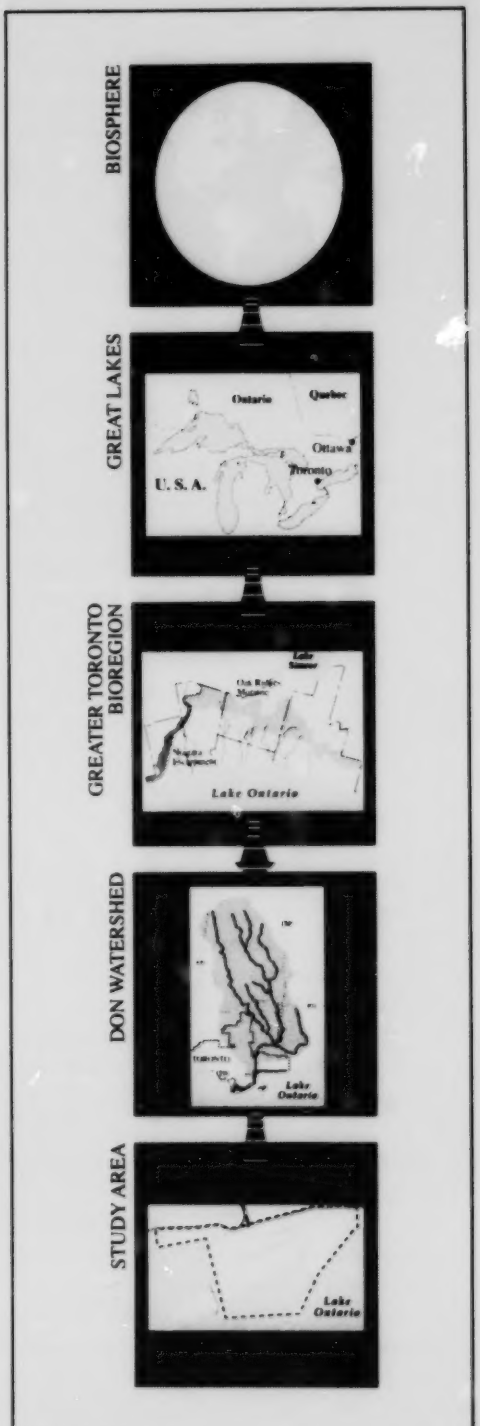


Figure 2 Ecosystems

approach to studying the area and planning for its future. An ecosystem approach should:

- use a broad definition of the environment: natural, physical, social, cultural, and economic;
- focus on links and relationships among air, land, water, and living organisms, including humans;
- recognize the dynamic nature of ecosystem processes;
- understand that humans are part of nature, not separate from it;
- emphasize the importance of living species other than humans, and of future generations;
- incorporate the concepts of carrying capacity, resilience, and sustainability;
- work to restore and maintain the integrity, quality, productivity, dignity, and well-being of the ecosystem.

As the Great Lakes Research Advisory Board explained in a 1978 report to the International Joint Commission, the ecosystem approach calls for "no more than the conductor of a symphony orchestra demands of assembled musicians; the director of a play, of actors; the manager of a factory or business, of workers." In each case the players are asked to perform their individual roles in harmony to create the larger whole. This way of thinking is reflected in the environmental audit: different aspects of the ecosystem were studied by different work groups and their findings were integrated as much as possible in order to explore ecosystem processes and health.

Using the ecosystem approach to study the environment of the area, five questions were posed to those involved in the audit:

1. What are the environmental conditions in the study area?
2. What relationships exist among the environments of the study area and the City of Toronto, the Don watershed, the Greater Toronto Bioregion, and the Great Lakes Basin?
3. What are the implications of the environmental conditions in the area for the health of the ecosystem, including human health?
4. How are human activities affecting other elements of the ecosystem (air, land, water, and wildlife)?
5. What measures are necessary to re-establish ecosystem integrity and restore beneficial uses?

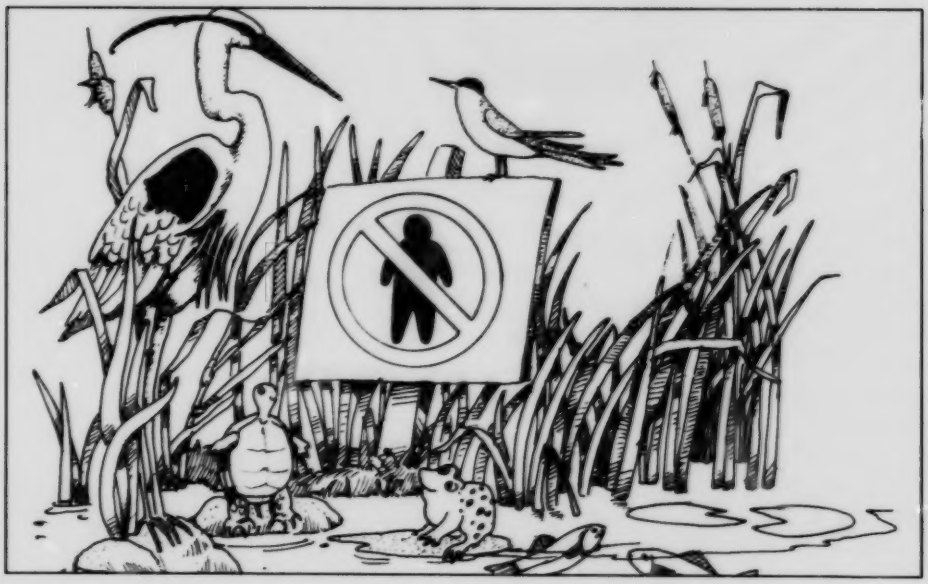
Values

Clearly, in considering the above questions it is necessary to understand the values humans apply in analysing and interpreting information about the environment. For example, what assumptions or value judgements are made in attempting to assess ecosystem health? Is a healthy ecosystem one that satisfies human needs for clean air and water, for shelter and safety, for jobs, for recreation? Or is a healthy ecosystem one that provides a range of good-quality habitats able to support a diverse, self-sustaining community of plants and animals?

The perspectives implicit in the last two questions illustrate, on the one hand, an anthropocentric view of nature based on perceptions of the value of the ecosystem to humans, and, on the other, a biocentric view that recognizes values in nature independent of human needs.

Although, if taken to extremes, these two viewpoints may conflict with one another, they can also be complementary. Indeed, an ecosystem approach requires that humans be considered as an integral part of the ecosystem, even while focussing attention on the needs of non-human species (and at the same time recognizing the difficulty of actually discarding our human values and biases).

Anthropocentric viewpoint



Biocentric viewpoint

An attempt was made to integrate the anthropocentric and biocentric viewpoints when assessing ecosystem health in the East Bayfront/Port Industrial Area. (This integration of viewpoints is reflected in the criteria used to evaluate ecosystem health in Chapter 3.)

Frameworks

A number of concepts and agreements contributed to the audit team's framework for interpreting information about the environment of the East Bayfront/Port Industrial

Area. These include: the idea of healthy communities; the *Ecosystem Charter for the Great Lakes-St. Lawrence*; the *Great Lakes Water Quality Agreement*; the goals developed for the *Metro Toronto Remedial Action Plan*; and the waterfront principles proposed in the *Watershed* report.

Healthy Communities

The concept of a healthy community (or healthy city) is based on a broad understanding of individual human health as a state of complete physical, mental, and social well-being. Three elements of a city or region that should be considered if people are to achieve and maintain good health are its environment, economy, and community (see Figure 3).

This model, developed by Dr. Trevor Hancock, illustrates the relationships among these three elements and the characteristics they must have to enable good health. These are:

- an environment that is viable (i.e., that supports human and non-human life), liveable, and sustainable;
- an economy that is equitable, sustainable, and adequately prosperous; and
- a community that is livable, equitable, and convivial.

Elaborating on these fundamental values, a healthy community clearly depends on many social, economic, and physical factors (see Box 1). Although most of these should be assessed and provided on a city-wide scale, it is useful to explore the extent to which an area within the city, such as the East Bayfront/Port Industrial Area, contributes to, or impedes, the fulfilment of healthy community ideals.

For example, the environmental audit team has asked whether physical and, to a lesser extent, social and economic conditions in the East Bayfront/Port Industrial

Figure 3 Healthy community model

Area contribute to:

- a clean, safe physical environment of high quality;
- an ecosystem that is stable now and sustainable in the long term;
- a high degree of participation and control by members of the public in and over decisions that affect their lives, health, and well-being;
- access to a wide variety of experiences and resources;
- a diverse, vital, and innovative city and regional economy;
- connectedness with the past (cultural and biological heritage);
- high health status (high levels of positive health and low levels of disease).

Ecosystem Charter

The purpose of the Ecosystem Charter, developed by the Rawson Academy of Aquatic Science in 1989 (see Box 2), is to promote ecosystem values in the Great Lakes Basin. It provides an ethical framework for human behaviour that should lead to greater compatibility between human activities and natural systems, and more sustainable development. The Ecosystem Charter has been used in the environmental audit

The Qualities of a Healthy City

- **City should provide:**
  - **a clean, safe physical environment of high quality (including housing quality);**
  - **an ecosystem that is stable now and sustainable in the long term;**
  - **a strong, mutually supportive and non-exploitive community;**
  - **a high degree of participation and control by the public over the decisions affecting their lives, health and wellbeing;**
  - **the meeting of basic needs (for food, water, shelter, income safety and work) for all the city's people**
  - **access to a wide variety of experiences and resources, with the chance for a wide variety of contact, interaction and communication;**
  - **a diverse, vital and innovative city economy;**
  - **the encouragement of connectedness with the past, with the cultural and biological heritage of city dwellers and with other groups and individuals;**
  - **a form that is compatible with and enhances the preceding characteristics;**
  - **an optimum level of appropriate public health and sick care services accessible to all; and**
  - **high health status (high levels of positive health and low levels of disease).**

THE HEALTHY CITY PROJECT

Box 1

ECOSYSTEM CHARTER

[1] To promote all measures and behaviours necessary to achieve and maintain local, basin-wide and global environments free from toxic and other degradations to the health, well-being, and enjoyment of all people and other living things, now and in the future;

[2] To use and conserve the environment and natural resources of the Great Lakes Basin ecosystem in ways that meet our various needs individually, collectively and corporately, without compromising the ability of future generations to meet their needs;

[3] To accelerate the healing of damaged ecosystem components by restoring, rehabilitating, and protecting: (i) the ecological processes of the Great Lakes Basin ecosystem; (ii) its natural communities; and (iii) its populations of indigenous species of plants and animals;

[4] To accept responsibility for: (i) maintaining the ecological processes and components of the Great Lakes Basin ecosystem; (ii) preserving biological diversity, and (iii) following the principle of sustainable use of ecosystem resources;

[5] To promote the right of all interested to be informed and the responsibility to learn in a timely manner of: (i) current conditions in the Great Lakes Basin ecosystem; (ii) any planned activity that might significantly affect the environment (including policy, enacting legislation and implementation), and (iii) equal access and due process in administrative and judicial proceedings;

[6] To cooperate in good faith with others living within the Great Lakes Basin ecosystem in implementing these obligations, and to cooperate with other people in other bio-geographic regions to achieve mutual objectives consistent with the above.

Box 2

REVISED
GREAT LAKES WATER QUALITY AGREEMENT
OF 1978

as amended by Protocol
signed November 18, 1987

"Impairment of beneficial use(s)" means a change in the chemical, physical or biological integrity of the Great Lakes System sufficient to cause any of the following:

(i)	*Restrictions on fish and wildlife consumption;*
(ii)	*Tainting of fish and wildlife flavour;*
(iii)	*Degradation of fish and wildlife populations;*
(iv)	*Fish tumors or other deformities;*
(v)	*Bird or animal deformities or reproduction problems;*
(vi)	*Degradation of benthos;*
(vii)	*Restrictions on dredging activities;*
(viii)	*Eutrophication or undesirable algae;*
(ix)	*Restrictions on drinking water consumption, or taste and odour problems;*
(x)	*Beach closings;*
(xi)	*Degradation of aesthetics;*
(xii)	*Added costs to agriculture or industry;*
(xiii)	*Degradation of phytoplankton and zooplankton populations; and*
(xiv)	*Loss of fish and wildlife habitat.*

Box 3

Metro Toronto Remedial Action Plan Goals

Goal 1: Toronto's waterfront and watersheds should be a diverse, healthy, integrated ecosystem. They should be managed using an ecosystem approach in order to restore beneficial uses of our aquatic resources. An ecosystem approach is a comprehensive and systematic consideration of the interacting components of air, land, water and living organisms, including humans.

Goal2: Toronto's watersheds and nearshore zone should provide citizens with fishable, swimmable, drinkable and aesthetically pleasing water and aquatic habitats.

Goal 2a: Any fish species indigenous to the Toronto waterfront and its watersheds should be able to return to the region, to live and naturally reproduce there.

Goal 2b: Opportunities to sustain and create fish and wildlife habitat throughout the Toronto watershed should be pursued in parallel with water quality initiatives.

Goal 2c: Within the waterfront, watershed and headwaters, protection of the remaining wetlands should be a primary concern. A priority for any development or remedial measure should be, where possible, to avoid effects on existing wetlands, and where possible to provide increases in wetland habitats.

Goal 2d: People should be able to consume fish from the Toronto waterfront and its watersheds without any restrictions resulting from contaminants of human origin.

Goal 2e: People should be able to swim and engage in water sports in Lake Ontario and Toronto's watersheds without risk of disease or illness.

Goal 2f: Levels of potentially toxic chemicals in Toronto's drinking water should not exceed acceptable standards as determined by the best scientific methodology available and when no health standards have been established, should not be detectable by the best scientific methodology available.

Goal 2g: The aesthetic quality of the waterfront, river valleys, ravines, wetlands and waterbodies should be of sufficient quality to enhance passive and active recreational uses for all people.

Goal 2h: Opportunities should be provided for residents and visitors to study or observe a functioning, healthy ecosystem.

Goal 2i: People should be able to swim and engage in water sports in Lake Ontario and Toronto's watersheds without encountering dangerous or hazardous materials.

Goal 3: Discharges to Toronto's waterfront and watersheds should not contain harmful micro organisms or hazardous chemicals at levels which impair beneficial uses, inhibit indigenous biota or produce other adverse impacts on the ecosystem.

Goal 3a: The quality of stormwater discharged to receiving waters should be of sufficient quality so that it does not impair beneficial uses, inhibit indigenous biota or produce other adverse impacts on the ecosystem.

Goal 3b: The discharge of combined sewage to receiving waters should be virtually eliminated and any remaining discharge should be of sufficient quality so that it does not impair beneficial uses, inhibit indigenous biota or produce other adverse impacts on the ecosystem.

Goal 3c: The quality of effluent discharged to receiving waters from sewage treatment plants should be of sufficient quality so that it does not impair beneficial uses, inhibit indigenous biota or produce other adverse impacts on the ecosystem.

Goal 4: The costs associated with environmental controls and rehabilitation should be the responsibility of those who are the source of pollution. It is explicitly recognized in the Metro Toronto RAP area that much of the pollution is caused by individuals and the public, including industry and agriculture.

Goal 4a: Cost effectiveness analysis should be used in RAP development and implementation to prioritize resources for water quality improvement.

Goal 5: The public should have sufficient access to Toronto's waterfront and valley systems in order to make them a focus of public involvement, recreation, enjoyment and cultural activities.

Goal 6: The volume of in–place and transported sediments being deposited in Toronto's watersheds should be stabilized at near natural levels by controlling their release at the point of origin. These sediments should be free of persistent contaminants, and contain safe levels of non–persistent contaminants.

Goal 7: Lakefilling should not be permitted unless it can be demonstrated not to impair beneficial uses of aquatic ecosystems. All possible means of improving the environment as a result of each project should be explored as part of the planning process in any development.

Goal 8: The atmospheric deposition of potentially hazardous substances resulting from human activities in the Toronto area should have no adverse impacts on the ecosystem.

Goal 9: Opportunities should be created and resources identified for the Metro Toronto RAP, in the spirit of cooperation, to have input to plans in other areas, such as the Niagara River or the setting of lake water levels, which have significant impact on Toronto's water quality.

Goal 10: Navigation and recreational uses in the Toronto waterfront should be maintained. An ongoing dredging option should be available so long as it is carried out in an environmentally acceptable manner.

Goal 11: Public awareness activities and consultation should continue throughout the RAP implementation phase.

Goal 12: There should be a mechanism for regular review of the goals and the implementation of the remedial action plan.

Box 4

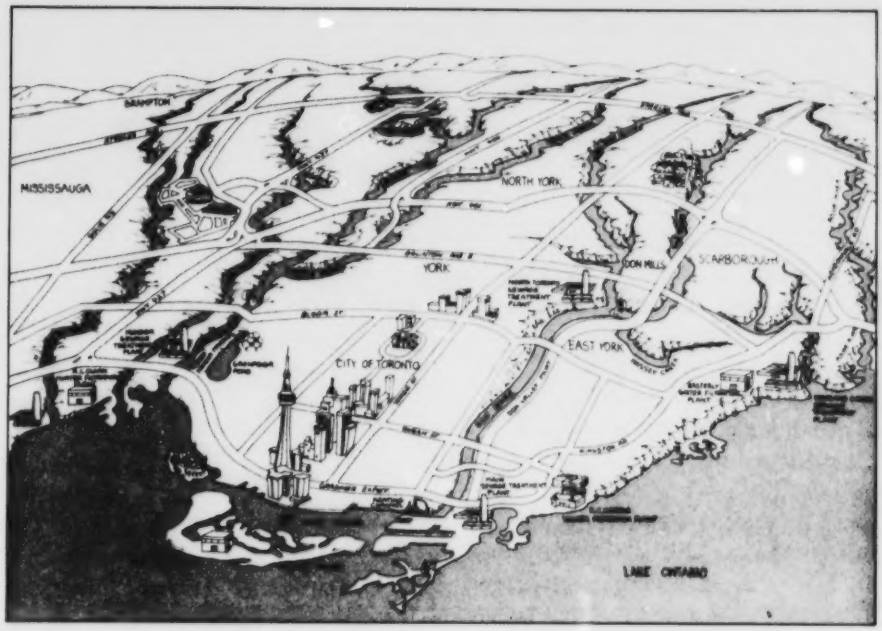


Figure 4 Metro Toronto Remedial Action Plan area

as a "code of conduct" to guide research and provide a context for thinking about restoring and enhancing the environment.

Great Lakes Water Quality Agreement

The *Great Lakes Water Quality Agreement* of 1978 (as amended in 1987) includes an Annex on Remedial Action Plans and Lakewide Management Plans. This Annex lists indicators of impairment of beneficial uses (see Box 3). These focus on many elements of the ecosystem — fish, wildlife, water, and sediment quality — in order to protect the uses of these resources. (These indicators were considered in developing the criteria for the assessment of ecosystem health discussed in Chapter 3.)

Metropolitan Toronto Remedial Action Plan (RAP) Goals

The East Bayfront/Port Industrial Area is at the centre of the Metro Toronto Area of Concern identified by the International Joint Commission for remedial action to address problems of water and sediment pollution. In 1989, the Public Advisory Committee of the Metro Toronto RAP published an excellent set of goals for the Plan (see Box 4). These goals, with their emphasis on the ecosystem approach, take a comprehensive view of the waterfront environment, and are applied to the East Bayfront/Port Industrial Area in our recommendations for future action (see Chapter 5).

Waterfront Principles

The *Watershed* report espouses a set of principles for dealing with the environment of the Greater Toronto waterfront, and these principles incorporate most of the ideas and goals mentioned above. The principles state that the waterfront should be:

- clean;
- green;
- useable;

- diverse;
- open;
- accessible;
- connected;
- affordable;
- attractive.

The environmental audit team looked at the applicability of the *Watershed* principles to the environmental audit of the East Bayfront/Port Industrial Area. It found that information gathered during the audit could be applied to a number of the principles — clean, green, useable, diverse, and connected — which led to the recommendations for improving ecosystem health described in Chapter 5 of this report. The remaining principles — open, accessible, affordable, and attractive — were deemed to be important for future decision-making concerning the area, but were not directly related to the environmental audit.

Within the context of the various frameworks (healthy communities, the *Ecosystem Charter*, the *Great Lakes Water Quality Agreement*, the *Metro Toronto Remedial Action Plan goals*, and the *Watershed* principles), the next two chapters examine the integrity of the East Bayfront/Port Industrial Area ecosystem, starting with a description of the parts that make up the whole — habitats.

CHAPTER TWO

HABITATS

If the ecosystem is a "home", the home can be divided into a number of different "rooms", each with its own characteristics and appeal. All ecosystems contain a number of rooms called habitats that are home to specific communities of plants and animals. This is true of the East Bayfront/Port Industrial Area.

The survival of each species depends on a particular combination of food, water, air, shelter, and territory. Together, these resources comprise the physical habitat, or home, of a given plant or animal. Familiar types of habitat for wildlife include wetlands, forests, meadows, and beaches. Human habitats — in the form of urban, suburban, or rural communities — are superimposed on natural ones. Within a city, for example, there are many habitats, such as high-rise apartments, garden suburbs, industrial areas, commercial centres, manicured parklands, remnant natural areas, and transportation corridors.

Habitats form the physical structures of ecosystems. They are visible, tangible, and relatively easy to study. Therefore, habitats are a useful place to begin examining the environmental conditions in the East Bayfront/Port Industrial Area. This chapter discusses the historical changes in the habitats of the study area, and outlines the mosaic of habitat types that exist today.

Historical Changes

Today, the East Bayfront/Port Industrial Area provides working and recreational habitats for people, as well as a variety of habitats for different forms of terrestrial and aquatic wildlife. However, when European settlers first arrived on the shores of Lake Ontario in the late 18th century, they found a very different place from the one we know today.

Pre-European Settlement

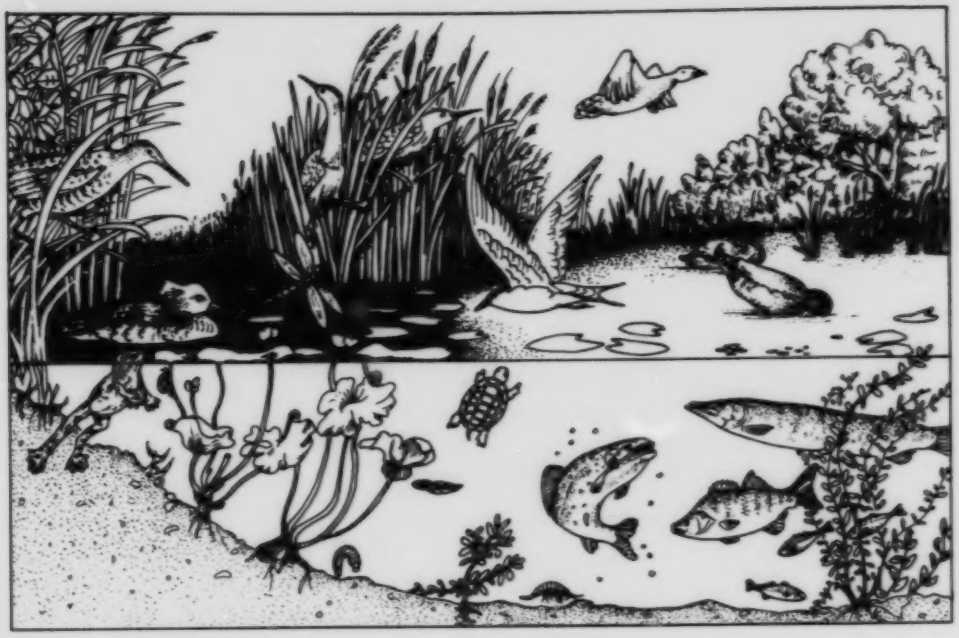
The waters of Toronto Bay, sheltered from the harsh conditions of the open lake by a curving, sandy peninsula, provided aquatic habitats for fish, water birds, and amphibians along the shoreline. The Don River, then in a natural condition with forested banks and clean water, emptied into a huge (486-hectare or 1,200-acre) estuarine wetland. Ashbridge's Bay, as this wetland was known, was a patchwork of ponds, weedy lagoons, bogs, and small islands. These habitats were diverse and highly productive, supporting a large population of many species of wildlife in a complex food web of plants, herbivores, and predators.

It is likely that most native settlements were located further up the rivers and streams, but the shores and wetlands along the lake would have provided rich hunting and fishing grounds and a base for temporary camps during appropriate seasons of the year.

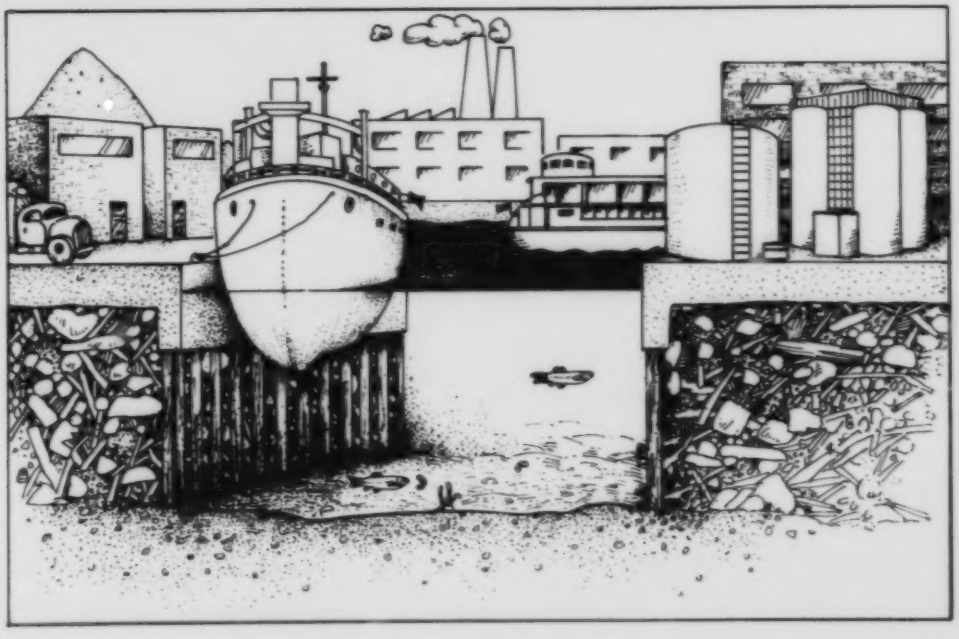
European Settlement

This part of the Lake Ontario shoreline offered a lot to the early European settlers: a sheltered harbour, abundant water supplies, timber from the forests, good soil for farming, and plentiful game and fish in the woods, wetlands, rivers, and the lake. As the Town of York grew, much of the life of the community centred on the wharves, warehouses, and markets located along Front Street, then on the water's edge. Ashbridge's Bay provided fish, turtles, and waterfowl for the dinner tables of the town's residents. The wetlands and peninsula were also favoured locations for summer cottages, boating, and recreational hunting and fishing.

Industries were another early feature of the waterfront. Gooderham and Worts Limited, whose distillery closed in 1990, started life in 1832 with a flour mill that ground wheat from local farms. Subsequent expansions included cattle-fattening and the pro-



Cross-section through Ashbridge's Bay before European settlement



Cross-section through the same area 200 years later

duction of rye whiskey and rum. Starting in 1903, several iron foundries and the British American Oil Company Limited also located their operations on the shores of Ashbridge's Bay.

The Don River was both a resource — for fishing, transportation, and recreation — and a source of aggravation for the developing City of Toronto. As it meandered towards the lake, the winding river hindered the development of infrastructure, such as railway tracks. This led to projects to straighten the course of the lower Don River and to reclaim a swampy area in the floodplain for use by the railways. The large quantities of silt disgorged by the river into Toronto harbour created a need for expensive dredging to allow continued navigation. Eventually, in 1883, a "government breakwater" was constructed along the eastern edge of the harbour to confine the siltation to Ashbridge's Bay.

In the waning years of the 19th century, the combination of stagnation caused by reduced circulation in Ashbridge's Bay, pollution from city sewers, and the waste discharge from as many as 4,000 cattle at Gooderham and Worts created terrible conditions in the Bay. Referred to by some local residents as "Mosquito Bay", it was described by a local newspaper as a "malarial swamp...teeming with pestilence and disease".

Industrial expansion early in the 20th century (Keating Channel in the foreground)

Port and Industrial Expansion

By the beginning of the 20th century, Toronto's harbour was the object of considerable ridicule: navigation was difficult, the water was severely polluted, shoreline access was obstructed by up to eight sets of railway tracks, and there was concern about control of waterfront development. After great civic controversy, the Board of Toronto Harbour Commissioners (THC) was created in 1911, paving the way for coordinated, sweeping changes to the waterfront. Within eight months, the THC had developed a comprehensive waterfront plan, in which development at the eastern end of

the harbour was a major priority.

Over the next two decades, implementation of the 1912 plan proceeded rapidly. Through dredging and lakefilling, most of Ashbridge's Bay was transformed into a land base for industry, with docks, a ship channel, and a turning basin. The delta of the Don River had vanished, and the river made an abrupt 90-degree turn into the Keating Channel. Lakefilling materials included not only dredgeate from the bay, but also construction debris, excavated soil, sewage sludge, incinerator refuse, and municipal garbage. A network of roads, railways, and bridges was built to link the Port with industry and the rest of the city. A variety of industries moved into the newly created industrial district; they included oil refining and storage facilities, coal yards, coal tar distilleries, tanneries, lumber yards, and metal foundries. Development of the East Bayfront proceeded more slowly, due in part to disputes and complicated negotiations between the City, THC, and the railways. In the 1950s, when the opening of the St. Lawrence Seaway created expectations of increased ship traffic in the Port of Toronto, a dockwall and three marine terminals (MT 27, 28, and 29) were created in the East Bayfront. A sugar refinery (formerly Canada and Dominion Sugar Company Ltd., now Redpath Sugar Ltd.) was the first industrial plant to locate there as a direct result of the new seaway and is still a prominent part of the East Bayfront.

Even in the era of industrial expansion, a considerable amount of wildlife habitat still remained in the area, particularly along its eastern and southern sides. In addition, lakefilled land not immediately used by industry was soon colonized by weedy plants, shrubs, and other flora, providing habitat for numerous species of birds, especially during migration. In 1952, the last vestiges of Ashbridge's Bay Marsh were destroyed to make way for the Main Sewage Treatment Plant.

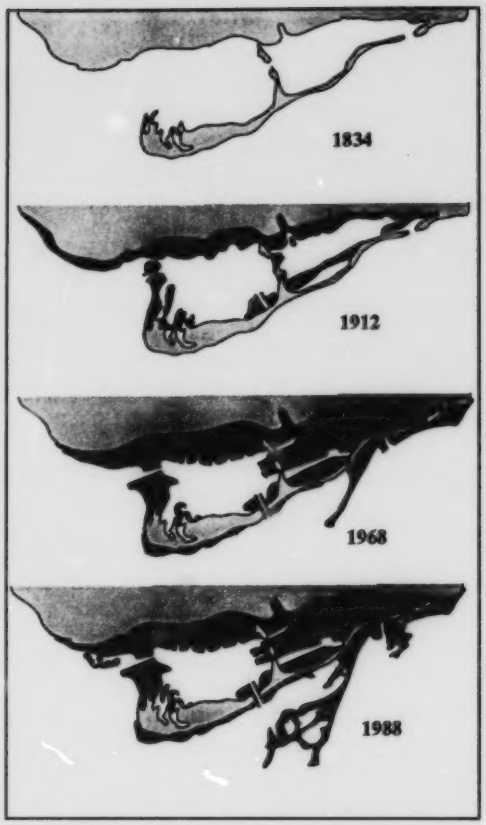


Figure 5 Toronto's changing central waterfront

In the 1960s, construction of a protective headland for a new "outer" harbour was commenced at the foot of Leslie Street. However, a second harbour was never needed, and the Outer Harbour Headland, or Leslie Street Spit, has developed through natural processes into a rich wilderness with an astonishing variety of plants and animals. The THC's most recent land creation project in the Port Industrial Area is the Outer Harbour Marina, begun in 1986 to provide facilities for recreational boating.

Habitats in 1991

Today, the East Bayfront/Port Industrial Area includes habitats for port, industrial, and recreational activities. Although the area

has no residential communities, it includes places for both work and play. The East Bayfront/Port Industrial Area also provides permanent homes and vital migratory habitats for birds, mammals, reptiles, amphibians, invertebrates, fish, and plants. The next three sections of this report describe wildlife habitats, human habitats, and the connections between them.

Wildlife Habitats

During the environmental audit, 12 types of aquatic and terrestrial habitat in the East Bayfront/Port Industrial Area were identified:

- Inner Harbour, slips, and channels;
- Outer Harbour;
- lakefill embayments;
- beach and gravelly shoreline;
- wet meadow/marsh;
- recent fill/semi-bare ground;
- open field;
- pre-woodland;
- willow thickets;
- cottonwood woodland;
- manicured open space/parkland;
- industrial lands.

The following are brief descriptions of the physical characteristics of these habitats, and their uses by wildlife. (More detailed information may be found in the Phase I and II *Natural Heritage* technical papers.) The quality and health of the habitats are assessed in Chapter 3: Ecosystem Health.

Inner Harbour, Slips, and Channels

The Keating Channel, East Bayfront, eastern edge of the Inner Harbour, Ship Channel, and Turning Basin are lined with dockwalls and provide little habitat for fish, due to the lack of vegetation, the limited structural diversity, an absence of natural edges, and the degraded quality of water and sediment. It is unlikely that any fish live in the channels permanently. However, the Keating Channel, with its constant flow of river

Ship Channel and Outer Harbour habitats

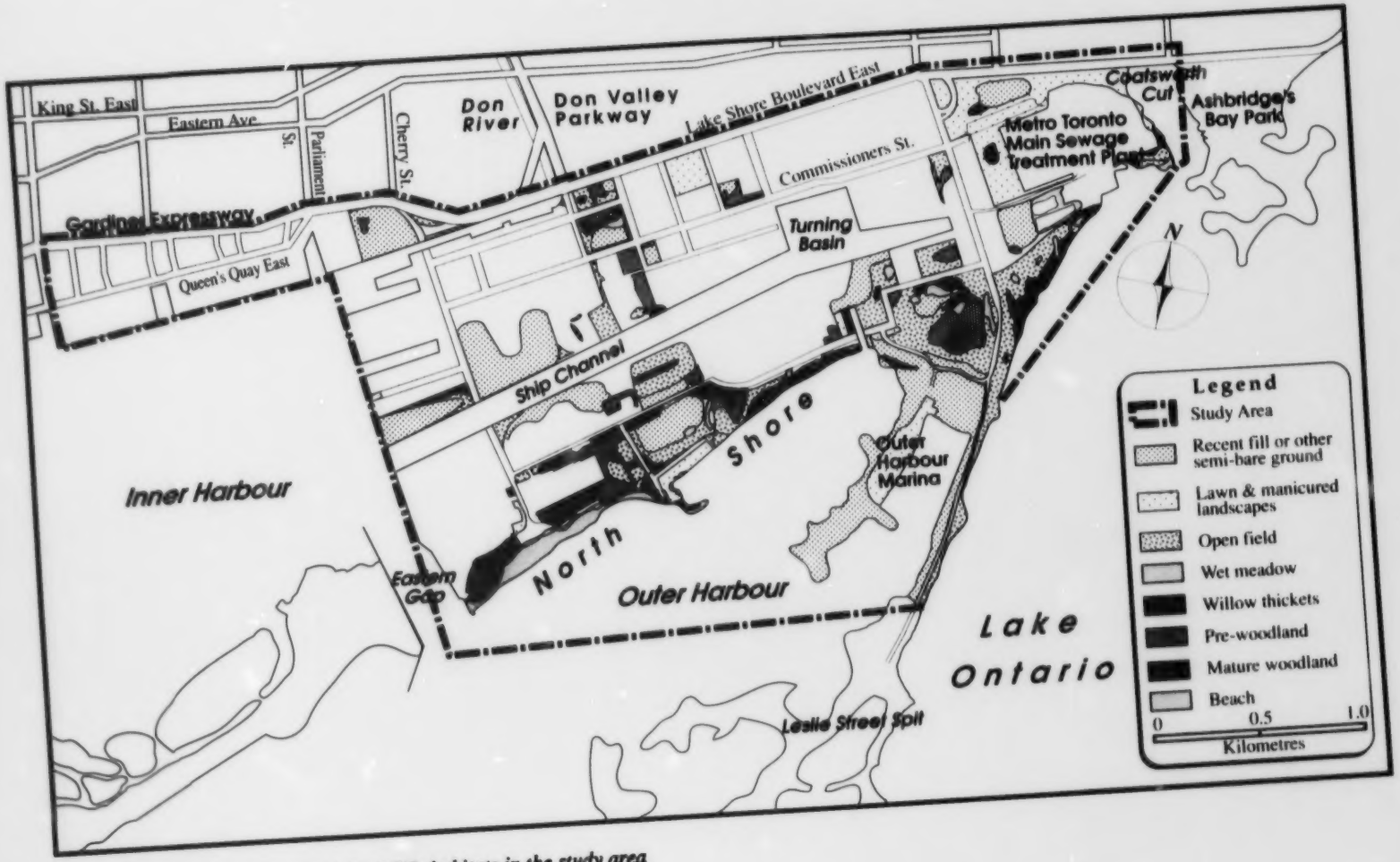


Figure 6 *Significant terrestrial wildlife habitats in the study area*

water and the food resources found in the river's detritus, appears to attract a greater variety of fish than the other dock/channel areas.

Wintering waterfowl, such as oldsquaw, goldeneye, and bufflehead, congregate in the channels and throughout the Inner and Outer harbours during the winter months, seeking protection from the harsh conditions of the open lake.

Outer Harbour

The Outer Harbour is characterized by a silt and sand substrate, with some areas of boulder, cobble, and gravel, and sporadic coverings of attached algae and other aquatic plants. This provides spawning habitat for such fish as alewife, gizzard shad, rainbow smelt, spottail and emerald shiner, and mottled sculpins. The area is also used extensively for feeding by forage and predator fish. A total of 15 species of fish, four of which are predators, were collected along the north shore of the Outer Harbour during the summer of 1990. A year-round survey would probably yield several more species, particularly coldwater fish such as brown trout and salmon.

Like much of the Toronto waterfront, the shoreline of the Outer Harbour is exposed to occasional but dramatic temperature fluctuations because of natural upwelling of cold waters from the lake. This prevents stable communities of warm-water fish from being established.

When the Hearn Generating Station was operating (up to 1983), warm water from its outfall attracted a greater diversity and abundance of fish species than at present (29 species were recorded in 1983). It was also a favoured location for wintering birds, including many different species of ducks, geese, and gulls, and unusual predators such as barred owl, Northern goshawk, and gyrfalcon.

Lakefill Embayments

The embayments and boat basins of the Outer Harbour Marina, Ashbridge's Bay Park, and Leslie Street Spit, because they are largely enclosed, provide a thermal refuge for fish during coldwater upwelling events along the shoreline. They also add to the overall habitat diversity along the shoreline, with areas of weed beds, and some rocky or rubble edges.

Coatsworth Cut differs from other embayments in and around the study area because it is subjected to occasional discharges of chlorinated, treated effluent from the seawall gates of the Main Sewage Treatment Plant during major storms. When these occur, fish seek refuge in the nearby Ashbridge's Bay boat basin. This is perhaps the main reason why Coatsworth Cut generally has a lower diversity of fish species than the other embayments (only nine species were recorded in 1989).

Beach and Gravelly Shoreline

The north shore of the Outer Harbour is composed of sandy and gravelly beaches. Vegetation is sparse, but includes some interesting species, including the provincially rare bushy cinquefoil and several regionally rare plants including the sea-rocket. Many shorebirds feed along the beaches during migration.

Wet Meadow/Marsh

There are seasonally flooded wet meadows and marshy areas at the base of the Leslie Street Spit, along ditches running south from Unwin Avenue to the north shore of the Outer Harbour, and in some vacant lots (former tank farms) near Commissioners Street. In some of these, low-growing grasses and rushes predominate. In others, there are tall sedges, cattails, and grasses, some of which (like the Baltic rush and river bulrush) are

regionally rare.

The wet meadows provide habitat for foraging leopard frogs and garter snakes, and breeding places for American toads and such birds as red-wing blackbirds and killdeer. A wide variety of shore and water birds find food and shelter in these areas during migration. The marsh-fringed ponds at the base of the Leslie Street Spit support a breeding population of leopard frogs which, in turn, provide food for herons.

Recent Fill/Semi-bare Ground

Some bare ground occurs in the East Bayfront/Port Industrial Area as a consequence of recent lakefilling, for example on the Outer Harbour Marina. In other cases, land formerly used for other purposes has been cleared and levelled. The presence of unsuitable substrates (such as coal, cinders, salt from snow dumping, and metal-contaminated soil) and/or soil compaction may also restrict plant growth.

In most cases, areas of bare ground are initially colonized (whether gradually or rapidly depends on the nature of the substrate) by weedy plant species. Salt-loving (halophytic) plants like the salt marsh sand spurrey and the rayless aster often appear in areas of snow-dumping.

Open Field

On well-drained land, semi-bare ground develops into the next successional stage: open fields composed of pasture grasses and a variety of flowering herbaceous species such as sweet white clover, asters, and mustards.

The flowers of the open fields provide an important food source for at least 27 species of butterfly recorded in the East Bayfront/Port Industrial Area. Garter snakes and various small mammals, including meadow voles, eastern cottontail rabbits, house mice, and white-footed mice, also find a home in these areas. The fields pro-

Beach habitat

Marsh and woodland habitat

vide nesting habitat for some birds (e.g., American goldfinches, savannah sparrows, horned larks, bobolinks) and a source of seed food for many migrating ones.

Pre-woodland

The open fields grade into a vegetation community with shrubs (such as staghorn sumac) and young trees (mainly willows and poplars). This habitat provides excellent food and cover for many small mammals, birds, insects, and snakes. At the base of the Leslie Street Spit, a pile of rubble, partially overgrown with young cottonwood, is believed to be a snake hibernaculum (winter hibernation site).

Willow Thickets

In damp areas and those exposed to high winds off Lake Ontario, dense thickets of sandbar willow have developed. They provide good cover for wildlife. In spring and fall they are filled with migrating warblers and other land birds. Also found in the willow thickets are two species of regionally-rare plants — the cut-leaved avens and Nelson's horsetail. It is likely that successional processes will ultimately result in transformation of the willow thickets to cottonwood woodlands.

Cottonwood Woodland

The shrubby pre-woodland communities and willow thickets are generally replaced over time by woodland composed of cottonwoods, typically with an understory of red osier dogwood, willows, viburnums, and honeysuckles. The major concentration of this habitat in the Port Industrial Area is around Cherry Beach. Once common along the Lake Ontario shoreline, the cottonwood/dogwood association is now quite rare in southern Ontario. The combination of trees and shrubs provides good cover for resident and migrating birds, particularly owls.

Manicured Open Space/Parkland

Manicured lawns, with occasional planted trees, occur in front of some of the buildings in the Port Industrial Area, around the Main Sewage Treatment Plant, in McCleary Park, in the Polson Quay parkette and in part of the Cherry Beach woodland. These areas provide habitat for a few species, such as American robins and house sparrows.

Industrial Lands

The industrial buildings and storage areas offer little habitat for wildlife, except perhaps to some of the less desirable imports such as Norway rats, house mice, and starlings. Although few bats were found during the audit, the old warehouses in the study area may prove attractive to them.

Overview of Wildlife Habitats

Despite the total destruction of the Ashbridge's Bay wetlands during the 20th century, the East Bayfront/Port Industrial Area still supports remarkable numbers of wildlife species. During Phases I and II of the environmental audit, observations were made and records were compiled of 330 species of plants (including 11 regionally and one provincially rare species); 260 bird species; 19 fish species; 12 species of mammals; two of amphibians; one snake species; and 27 species of butterflies. These numbers of species are comparable to those for the Leslie Street Spit, particularly for plants (estimated to include more than 300 species) and birds (284 species recorded).

The key areas of terrestrial wildlife habitat are concentrated along the north shore of the Outer Harbour and the base of the Leslie Street Spit, and in several vacant lots. For the most part, they have developed as a consequence of human neglect, and the result — a varied mosaic of habitats in different stages of succession and along moisture gradients — provides excellent areas for breeding and migrating wildlife. Moreover, the value of these locales to wildlife is probably protected by the way they are used by people. Many visitors are naturalists; joggers, hikers, and cyclists typically stay on the Martin Goodman Trail; while visitors to Cherry Beach and boaters and boardsailors concentrate along the shoreline.

The aquatic habitats of the north shore of the Outer Harbour are typical of a relatively unaltered shoreline along Lake Ontario — there is limited structural habitat and some macrophyte growth. Exposure to periodic upsurges of cold water from the deeper waters of Lake Ontario limits the development of stable warm-water fish communities. The embayments and boat basins of the Outer Harbour Marina, Leslie Street Spit, and Ashbridge's Bay add to the overall habitat diversity and provide thermal refuges. The Keating and Ship channels, in contrast, represent very degraded fish habitat.

Human Uses

Work

The East Bayfront/Port Industrial Area provides people with a working habitat close to the heart of the city. It is the largest industrial area remaining in the City of Toronto, making up 40 per cent of that municipality's designated industrial-district lands. However, the area represents only four per cent of the industrially designated land in Metropolitan Toronto (see Figure 7).

In 1989, industries and businesses in the study area provided jobs for 10,134 people — 5,419 in the East Bayfront and 4,715 in the Port Industrial Area. Employment in the East Bayfront is dominated by office jobs (65 per cent of the total). In the Port Industrial Area, 36 per cent of jobs are in the terminal storage, transportation, and communication sector; 32 per cent are in manufacturing (this includes sewage treat-

Table 1: Full and part-time employment in the East Bayfront/ Port Industrial Area in 1989.

CATEGORY OF EMPLOYMENT	East Bayfront			Port Industrial Area			EB/PIA Area combined		
	Full-time #	Part-time #	Total #	Full-time #	Part-time #	Total #	Full-time #	Part-time #	Total #
Residential	0	0	0	0	0	0	0	0	0
Manufacturing *	818	10	828	1,479	23	1,502[b]	2,297	33	2,330[a]
Terminal Storage Transp. and Comm.	370	94	464	1,578	124	1,702[b]	1,948	218	2,166[a]
Shopping, Services Repair Servicing and Rentals	248	34	282	198	44	242	446	78	524
Office	3,203	337	3,540	952	125	1,077	4,155	462	4,617
Institutions	193	5	198	13	1	14	206	6	212
Entertainment and Recreation	84	18	102	17	11	28	101	29	130
Resource Production and Extraction	0	0	0	0	0	0	0	0	0
On Site Construction	5	0	5	150	0	150	155	0	155
TOTAL	**4,921**	**498**	**5,419**	**4,387**	**328**	**4,715**	**9,308**	**826**	**10,134**

a Includes approximately 325 sewage treatment employees.
b Includes approximately 625 bus depot employees.
* On Site Construction / Renovation / Maintenance (Code 49) listed separately.

Source: Metro Toronto Planning Department, LUAC Employment Survey.

ment); and 23 per cent are office-related.

Partly because so much of the land in the Port Industrial Area is vacant or used for bulk storage, job density is low. On average, Toronto's industrially designated lands provide jobs for 32 people per acre, and in the East Bayfront there are 48 people employed per acre; by contrast, the density in the Port Industrial Area is only 4.7 employees per acre.

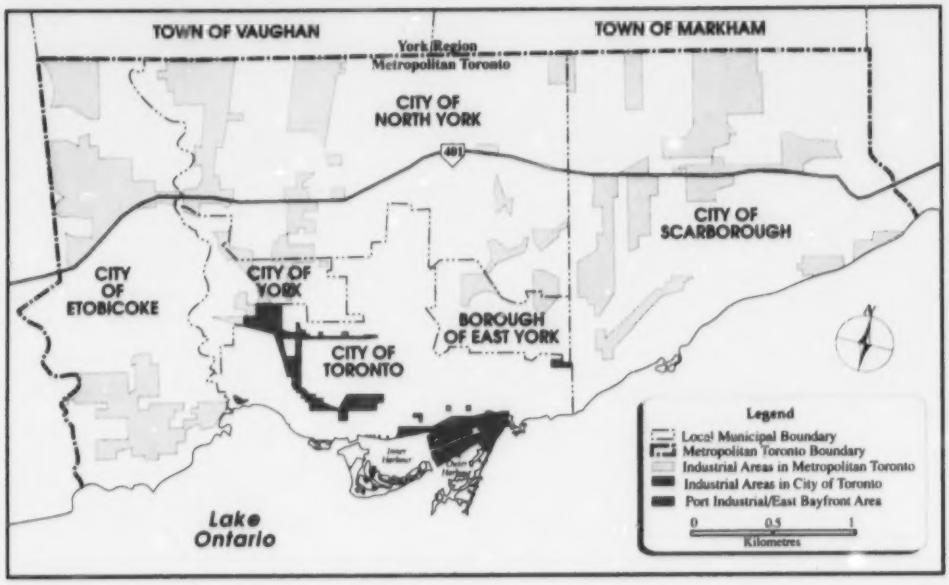


Figure 7 Industrial lands in Metro Toronto

According to the Metropolitan Toronto Planning Department, data on employment change in the study area from 1983 to 1989 show that, although employment grew by 1,157 jobs (13 per cent), this growth was heavily weighted to part-time employment. Between 1983 and 1989, part-time employment grew by 215 per cent (564 jobs), while full-time employment grew by seven per cent (593 jobs). Growth was heavily concentrated in the terminal storage, transportation, and communication category with the addition of 1,288 mainly full-time jobs, a growth rate of 147 per cent. (Nearly half these new jobs were created when a bus depot was established.) Major losses were experienced in the office category, which lost 1,074 full-time jobs and gained 409 part-time jobs for a net change of -13 per cent.

Economic activity in the East Bayfront/ Port Industrial Area revolves around transportation (materials are brought into and distributed out of the area by ship, rail, and truck). A 1990 survey undertaken by the Toronto Harbour Commissioners showed that ships brought 53 per cent of inbound tonnage but only about two per cent of outbound materials left by water.

Other economic activities include storage of bulk materials, and production or recycling operations involving scrap metals, petroleum products, foods, construction materials, paper, paperboard, and the like. Office jobs are also important in both the East Bayfront and the Port Industrial Area. Utilities, in the form of the Main Sewage Treatment Plant and the Hearn Generating Station (currently moth-balled), are located on some of the largest sites in the study area.

The Port, slips, and channels provide shipping access to docking terminals for such commodities as cement, sugar, salt,

aggregates, soybeans, liquid bulk materials, steel products, and general cargo. The giant pyramids of highway salt stored and distributed by the Canadian Salt Company, Akzo Salt Ltd., and Domtar Sifto are a dominant feature of the landscape along the south side of the Ship Channel.

Cement is another major commodity moving through the Port, to supply Metro's construction industry. Lake Ontario Cement and Canada Cement Lafarge currently operate on the western side of Cherry Street. McCord Cement, which has left its former site north of the study area to make way for the Ataratiri housing development, has relocated on the eastern edge of the Turning Basin.

Redpath Sugar is currently the major industry in the East Bayfront, importing an average of 300,000 tonnes of raw sugar each year for refining, packing, and distribution. The East Bayfront is also the site of the Queen Elizabeth Docks (Marine Terminals 28 and 29), which were built during the 1950s in anticipation of increased ship traffic when the St. Lawrence Seaway opened. However, after a brief increase, shipping dropped off with the introduction of containerization, and the Queen Elizabeth docks are currently used for non-marine purposes — a sports club, Canpar parcel distribution, and Voyageur Bus Lines.

Hazardous Materials

As can be expected in an industrial area, hazardous wastes are generated and many hazardous materials stored, used, and transported throughout the East Bayfront/Port Industrial Area. There are several thousand hazardous chemicals in use in the area, 28 generators of hazardous wastes and 15 sites for storing PCBs (polychlorinated biphenyls) (see Figure 8). The hazardous materials — such as chlorine, ammonia, caustic soda, acids, petroleum products, and solvents — may be explosive, flammable, corrosive, harmful to health, and/or toxic to wildlife.

There is no information available on quantities, storage and handling procedures, safety measures or levels and duration of exposure by which to assess the risks of hazardous materials in the East Bayfront/Port Industrial Area. However, there are records

Figure 8 PCBs in use and PCB storage sites

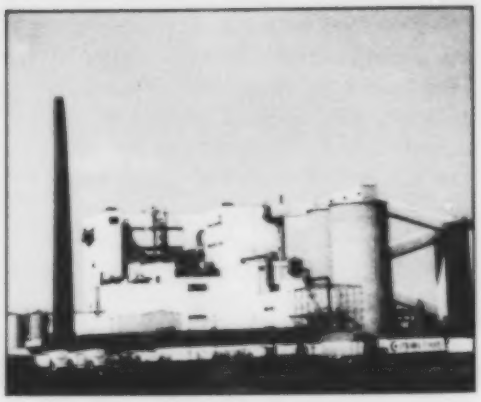
of recent incidents in which they were involved. From January 1989 to November 1990, the Toronto Fire Department responded to 25 fires, 16 hydrocarbon spills, and eight chemical spills in the East Bayfront/Port Industrial Area. Three of these incidents were rail accidents and three of the fires involved PCBs. The Ministry of the Environment's Spills Action Centre was notified of 24 spills into the Toronto Harbour, including those involving various food oils and petroleum products.

Another potential hazard is posed by the presence of a maze of underground pipelines in the East Bayfront/Port Industrial Area, most of which have been used, or are still in use, for transporting petroleum products in the area. When they are no longer needed, these pipelines are usually sealed while full of the petroleum product (to avoid the risks of welding a pipe containing an explosive mixture of air and petroleum products). This creates the possibility of leaks and/or explosions if a pipeline deteriorates or if it is ruptured during land redevelopment activities.

Responsible Industries

For the most part, industries in the East Bayfront/Port Industrial Area have been viewed as dirty, smelly, and noisy — best left "out of sight, out of mind". Many of the most polluting industries have left the area, leaving behind them a legacy of contaminated soils and groundwater. Many of the remaining industries are adopting more environmentally responsible operations in response to changing public attitudes towards the environment, employee concerns for health and safety, and increased government regulation.

For example, most of the industries contacted during the hazardous materials study of the environmental audit responded promptly with copies of Material Safety Data Sheets, which provide information on hazardous materials under the Workplace



Redpath Sugars, East Bayfront

Hazardous Materials Information System (WHMIS). Many industries, especially those that are members of the South East Toronto Industrial Awareness Organization (SETIAO), have adopted environmental policy statements they apply to many aspects of their businesses: product formulation, production processes, energy use, emissions, management of hazardous materials, workplace safety, worker health, packaging, facilities, and waste management, among others. Some of the larger companies employ people specifically to take care of environmental programs, and deal with neighbourhood residents through the South Riverdale Environmental Liaison Committee.

Recreation

All but hidden behind the heavy industries and portlands in the East Bayfront/Port Industrial Area lie some recreational areas valued by Toronto residents. Many of the recreational uses are concentrated along the north shore of the Outer Harbour: Cherry Beach is still one of the cleanest swimming beaches in Metro Toronto and an attractive spot for boardsailors. Sailors and rowers use a cluster of nine boat clubs along the north shore east of Cherry Beach. The new Outer Harbour Marina built by the Toronto Harbour

McCleary Park, with former Commissioners St. incinerator in background

Commissioners provides berths for 400 sail and powerboats. Behind the north shore, the semi-natural areas of open field, scrub, and woodland — with the Martin Goodman Trail winding through them — provide one of the most pleasant open spaces for walking, cycling, and bird-watching close to the city.

The City of Toronto's McCleary Park, sandwiched between Lake Shore Boulevard and the former Metro Toronto Incinerator, provides space for sports such as baseball and soccer. It is used by residents of the South Riverdale area and other groups across Toronto. Although the park is close to South Riverdale, it can be reached by those arriving on bike or foot only after they have braved the railway and Gardiner/Lakeshore Corridor. A parkette at the foot of Polson Street provides an interesting spot for a work-day lunch or for a pause on a weekend bike ride, with a spectacular view of the Inner Harbour, Toronto Islands, and the City.

Connectedness

In addition to documenting the different types of habitats in an ecosystem, and their uses by humans and wildlife, it is important to know about connections among habitats, connections to places outside the ecosystem, and connections with the area's heritage.

Wildlife

Because most organisms depend on more than one habitat to fulfil their needs, the overall mosaic of habitats, and especially connections among them, are crucially important. In the study area, for example, American goldfinches nest in the woods and feed in the open fields. Gulls, terns, and black-crowned night herons that nest on the Leslie Street Spit use the base of the spit and the north shore for loafing and feeding.

Many migratory birds and butterflies pass through the area during spring and fall, and many other birds spend the winter on

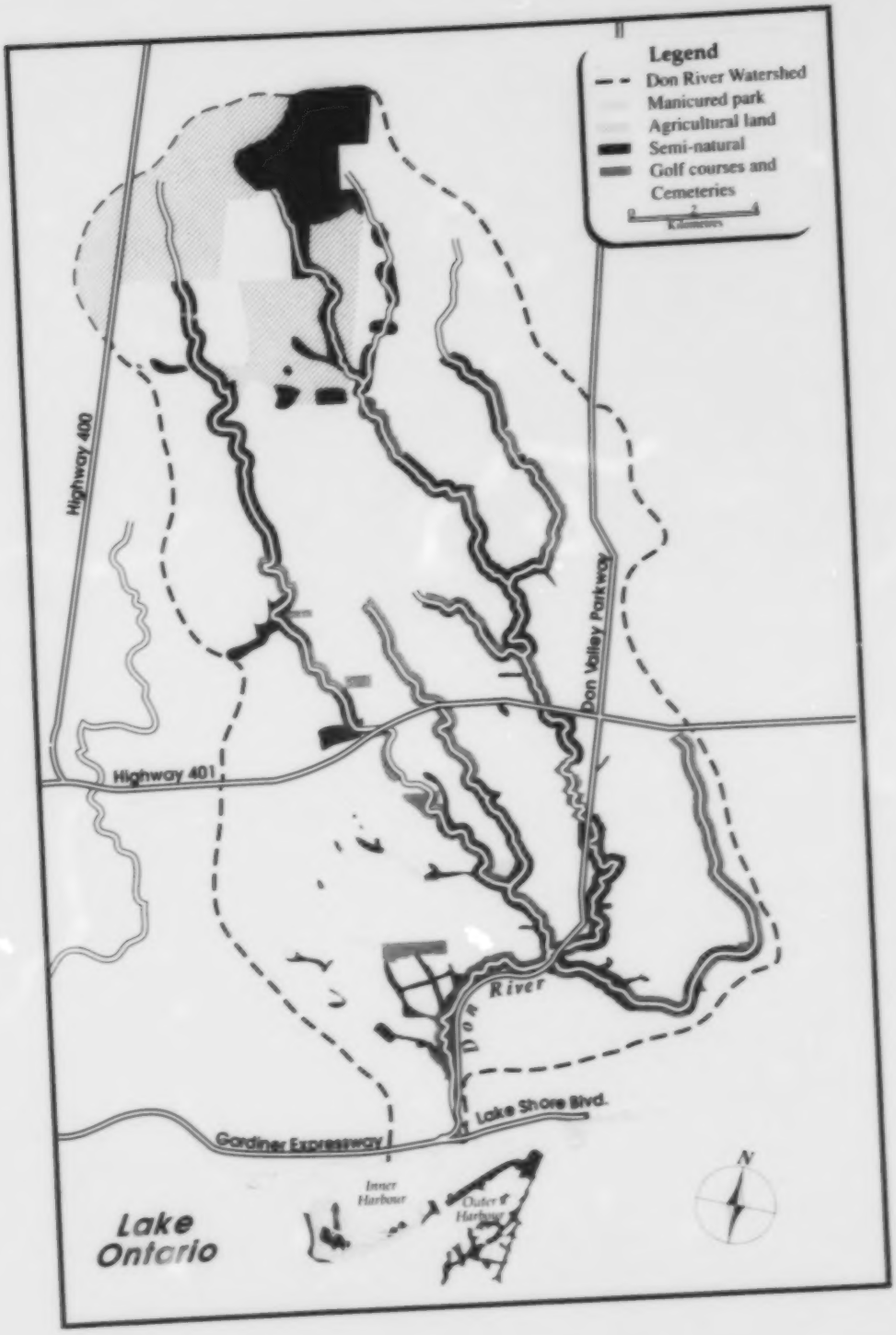


Figure 9 Green corridors in the Don Watershed

the Toronto waterfront. As part of the annual migration cycle, any natural area on the waterfront is a crucial link in the chain of resting and feeding areas along the migratory flyway. The Port Industrial Area is in a particularly strategic location — between the Leslie Street Spit, which acts as a funnel for the lake crossing, and the southern end of the Don Valley, which is a major migration route. However, the connection with the Don Valley, once a natural rivermouth with major estuarine wetlands, is a vestige of its former self. The industrial areas provide little green space other than some vegetated vacant lots. The Gardiner/Lakeshore Corridor is a major barrier, and the lower Don River itself is confined in the strait-jacket of a concrete channel.

The close proximity of the Toronto Islands, the Leslie Street Spit, and the north shore provides complementary habitats for some species of birds during different seasons. For example, the north shore, which is more protected from the harsh elements than the other areas, has a more moderate microclimate and provides shelter and food earlier in the spring and later in the fall. The north shore also provides a connecting route for the dispersal of wildlife (plants, insects, frogs, snakes, and mammals as well as birds) to colonize the Leslie Street Spit from such sources as populations on the Toronto Islands.

Similarly, there are beneficial relationships among aquatic habitats in the area. For example, during periods of upwelling of cold waters from Lake Ontario, the embayments and lagoons of the Leslie Street Spit and Ashbridge's Bay Park provide fish with thermal refuges from more exposed areas such as the Outer Harbour.

Flooding

The East Bayfront/Port Industrial Area is also connected to the Don watershed by the flood potential of the lower Don River. In the event of a regional storm of the magnitude of 1954's Hurricane Hazel, most of the study area north of the Ship Channel would be flooded to a depth of up to one metre, with some areas flooded even more seriously.

Under the Flood Plain Planning Policy Statement issued by the Ministries of Natural Resources and Municipal Affairs, new development susceptible to flood damage from regional storms is not normally permitted. However, municipalities may apply for special policy area status to allow controlled development in areas where it is not feasible to restrict new development.

In August 1989, the Ministries of Natural Resources and Municipal Affairs, and the Metropolitan Toronto and Region Conservation Authority approved in principle an application by the City of Toronto for a special policy area in the Lower Don floodplain, including the Ataratiri site and parts of the East Bayfront/Port Industrial Area. Studies have been conducted to calculate the flood flow, levels, and velocity, and to model the potential floods. The actual extent of the special policy area is being reviewed in light of the new information revealed by these studies. A variety of measures are being considered to reduce the flood risk.

Human Access

People gain access to the East Bayfront/Port Industrial Area by car, bus, boat, bicycle, and less commonly on foot. The area has limited public transit, with several different bus routes along parts of the East Bayfront, and two Port District bus routes that terminate at Commissioners Street.

The Martin Goodman Trail, which is used by walkers, joggers, and cyclists, runs from Harbourfront along the East Bayfront, down Cherry Street into the Port Industrial Area, through the semi-natural areas of the north shore, and north along Unwin Avenue, or south to the Leslie Street Spit (a very popular area for cycling). There is now no easy north-south access to the bicycle trails of the

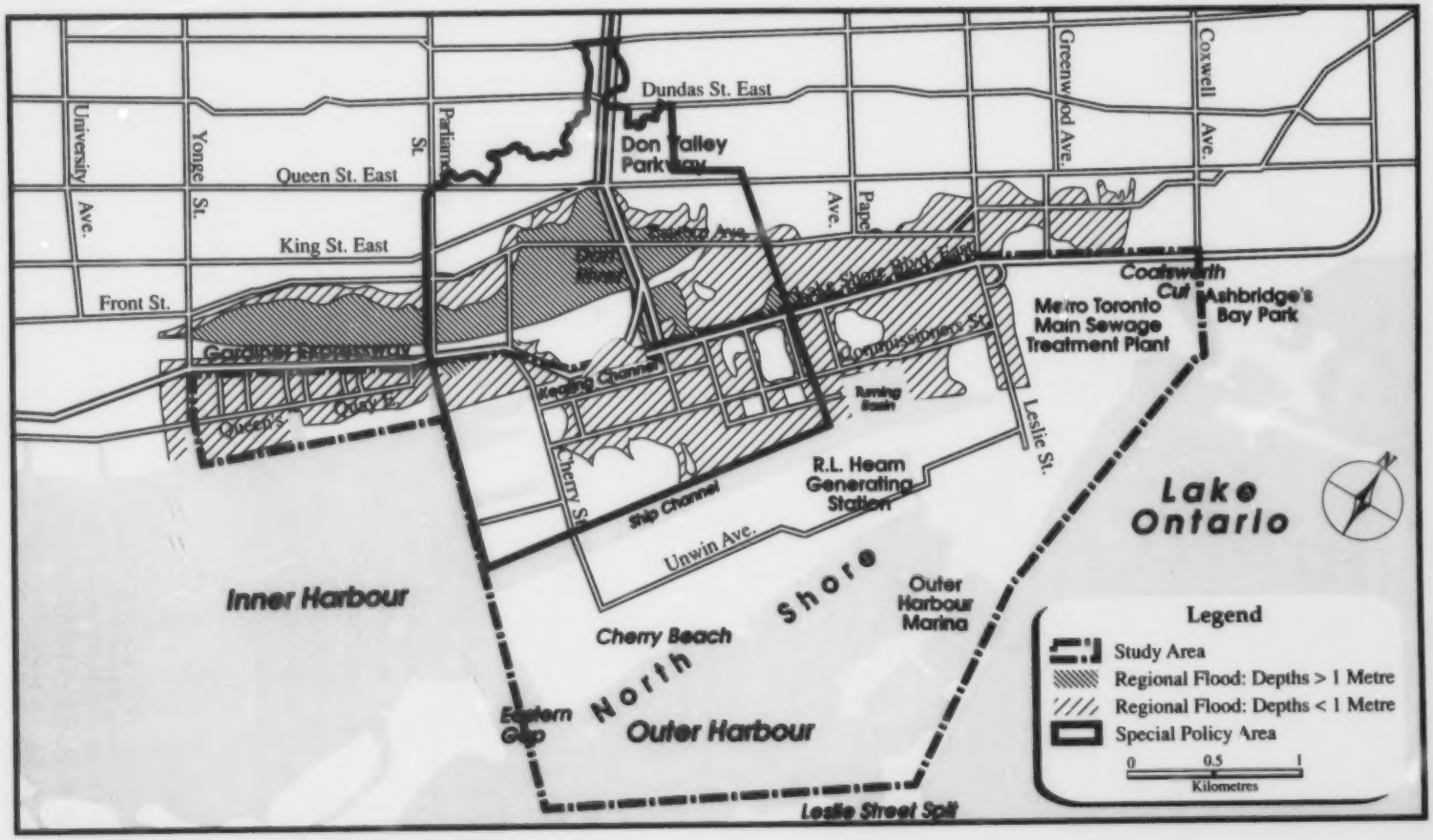


Figure 10 Potential flood conditions and special policy area

Figure 11 Access

Don Valley. Although the Martin Goodman Trail provides a more-or-less continuous cycle route through the East Bayfront/Port Industrial Area, much of it is parallel to roadways, where cyclists are exposed to dust, noise, and exhaust fumes, and to the many hazardous intersections they must cross.

Heritage

The above connections are spatial, but there are also temporal connections with the natural and cultural heritage of the East Bayfront/Port Industrial Area. Although most of the original natural heritage of the study area — the Ashbridge's Bay wetlands and sand spits — has vanished, there are reminders of its former glory: thousands of birds and butterflies still migrate annually through the area, stopping to rest and feed before or after the gruelling lake crossing.

Work undertaken for the Toronto Harbour Commissioners on the heritage of the Port Industrial District (Stinson 1990) demonstrates how the present landscapes of the area evoke connections with Toronto's industrial history. It shows that the legacy of the area's primary uses — transfer and storage — is a relatively open landscape, the historic role of which is only partly described in bricks and mortar. Rather, the character of the area is expressed in the patterns of docks, ship channels, railways, and wide boulevards that reflect the grand dreams of the early 20th century and provide a framework for present-day activities. The penetration of ship channels and docks into the land, and the proximity of the Inner and Outer harbours, ensure the continual presence of the land-water interface. Ships, barges, and dredges are juxtaposed with oil tanks, piles of salt and cement, silos, tall chimney stacks, scrap yards, and warehouses.

If some of this industrial heritage is retained, even as land uses change, future generations will be provided with a better sense of continuity and meaning as they are able to make connections with the people, places, and events of the past.

This brief review shows that there are opportunities to improve connectedness in the East Bayfront/Port Industrial Area among wildlife habitats, human access, and the natural and industrial heritage. These opportunities are explored in more detail in Chapter 5.

CHAPTER THREE

ECOSYSTEM HEALTH

Given the definition of a healthy ecosystem as one having integrity, or the ability to maintain its organization, is the East Bayfront/Port Industrial Area healthy? Does it have integrity? The environmental audit was set up to answer such questions, by providing the best possible understanding of the environmental conditions there. Chapter 2 describes the examination that was made of the habitats, the structures and patterns, in the study area. Using an ecosystem approach, this chapter explains how things function there — the relationships between the study area and its surroundings, and the interrelationships within the study area itself. At the end of the chapter, there is a discussion of the criteria used to measure the health of the study area, and some conclusions about its integrity.

Regional Relationships

The East Bayfront/Port Industrial Area is nested in many larger ecosystems, including the Don watershed, the Greater Toronto Bioregion, the Great Lakes Basin, and, ultimately, the biosphere itself. The study area both affects these ecosystems and is affected by them.

The atmospheric environment in the East Bayfront/Port Industrial Area, for example, is greatly affected by pollutants generated outside it, particularly sulphur dioxide and the chemical precursors that form ozone. Transport of trace organic compounds from distant sources is probably responsible for the presence of a good many of these compounds in the air of the study area. Global weather patterns and the proximity of Lake Ontario contribute greatly to the climatic conditions in the area, as does the warming effect of the Metro urban area. The five-day "airshed" (the region that influences the atmosphere of the Great Lakes Basin) has been estimated to extend as far as Hudson Bay to the north, the Dakotas to the west, central Georgia to the south, and New Brunswick to the east (see Figure 12).

Water and sediment quality in the study area is affected somewhat by pollution coming from such "upstream" sources in the Great Lakes system as the Niagara River. Greater effects are felt from point and non-point sources in the watershed and headwaters of the Don River. These influence the quantity and quality of sediments coming down the river and into the Keating Channel. The sanitary and storm water systems for large parts of the cities of Toronto, Scarborough, North York, and East York have a considerable impact on the water quality in the study area. Water and sediment quality is also influenced by currents and coastal processes that move pollutants and alter nearshore temperatures.

The soils and waters of the study area are affected, to a largely unknown degree, by transport of air pollutants over long distances and by the deposition of these pollutants in soil and water. For example, it has been estimated by the Ontario Ministry of the Environment that each year 300 kilograms (660 pounds) of lead are deposited in the waters of Humber Bay and the Inner Harbour, and 18,000 kilograms (39,600 pounds) of lead deposited on lands in Metro Toronto.

While it is clear that the environment of the port area is significantly affected by factors outside it, the area, in turn, affects those distant places. Although pollutants generated in the study area are a small percentage of those produced in Metro Toronto, emissions from the port area do affect the environment outside its boundaries. South Riverdale residents, for example, are adversely affected by odours from industries in the study area and from the Main Sewage Treatment Plant. The emissions from the Gardiner/Lakeshore Corridor affect air quality outside the study area, although their exact impact is unknown. The metals and organic chemicals in soils in the area have contaminated underlying groundwater, which flows into the Inner and Outer harbours.

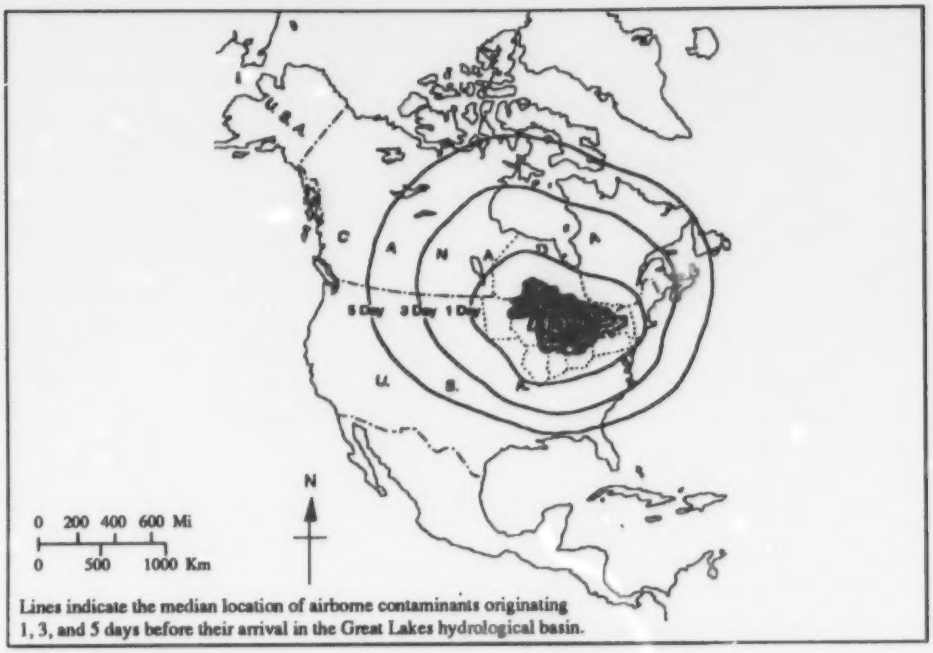


Figure 12 Atmospheric region of influence for the Great Lakes Basin

Based on the ecosystem approach, the next section describes how contaminants and nutrients cycle and move in the study area; the sources and levels of pollution; and the pathways by which humans and other organisms are exposed to pollution.

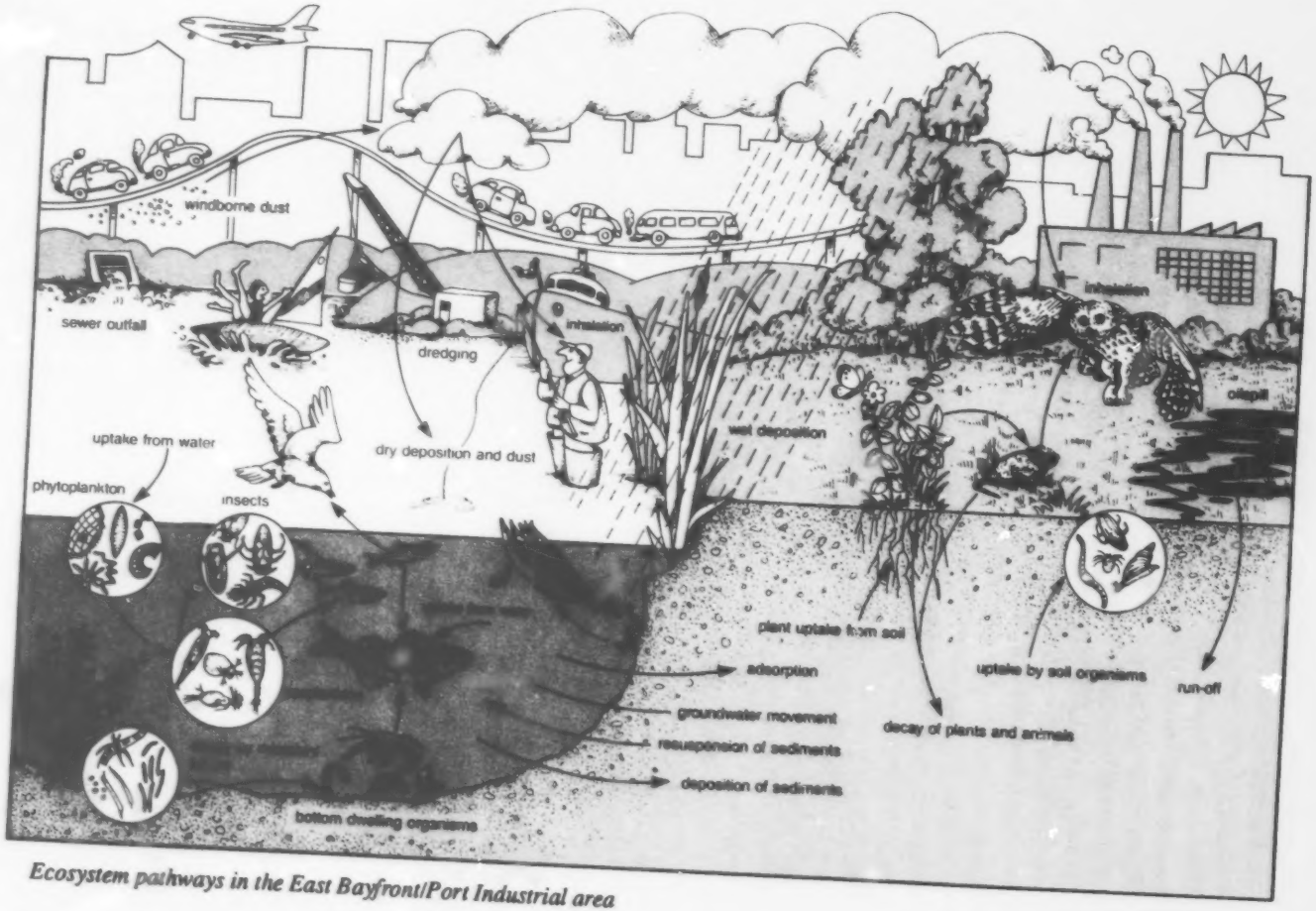
Ecosystem Function

Ecosystems are dynamic and their components are interconnected. This section traces the transfer of nutrients and toxic chemicals to show how the ecosystem functions in the study area. Six media have been examined: air; soils and groundwater; sediments; surface waters; aquatic biota; and terrestrial biota. The environmental conditions of each medium in the study area are summarized and loadings to each are discussed. Finally the "effluxes" — the movements from one medium to another — are considered.

Nutrients and toxic chemicals move in an ecosystem in complex and sometimes poorly understood ways. The constant cycling through air, water, soil, and biota is shown in the sketch of ecosystem pathways, which illustrates the fundamental principle of the ecosystem approach — "everything is connected to everything else".

Air

Typically for an industrial district, air quality in the East Bayfront/ Port Industrial Area is relatively poor. There, as in Metro and southern Ontario generally, ozone levels are a problem during warm daytime hours in the late spring and summer. Sulphur dioxide and nitrogen dioxide are not currently a problem, although nitrogen dioxide could become one if new development were allowed in a form that would confine air movement along the



Ecosystem pathways in the East Bayfront/Port Industrial area

Gardiner/Lakeshore Corridor. Preliminary modelling indicated that carbon monoxide, suspended particulates, and dustfall along the corridor probably exceed provincial guidelines, especially near exit ramps, but these pollutants have not been measured. Similarly, fugitive emissions of dust, metals, and volatile organic compounds from industries and traffic in the study area may be a problem, but the extent of that problem has not been assessed.

In general, little is known about the levels of trace organic compounds in the area's air; certainly, the presence of lead in the air and in dustfall is a concern in the eastern part of the study area, because of the presence of the nearby Canada Metals plant. Moreover, it is likely that there are high levels of lead in soil from auto emissions along the Gardiner/Lakeshore Corridor.

Odours from the study area (particularly the Main Sewage Treatment Plant) and from industries in South Riverdale are a continuing problem for nearby residents. Statistics show a net increase in complaints for 1990 over 1989 (even excluding those attributed to the two rendering plants in the area, both slated to move).

Generally speaking, air pollution in Ontario (and, therefore, the study area) should improve after the Province's proposed Clean Air Program and its tougher vehicle emission program are implemented. However, Metro's proposal to increase the incineration of sludge at the Main Sewage Treatment Plant may increase emissions from the plant, as will the restart of the Ontario Hydro's Hearn Generating Plant (temporarily on hold). Ontario Hydro has estimated that, when the plant is operating again, it will emit an additional 1,000 tonnes (1,100 tons) of nitrogen oxides annually, almost doubling the emission of nitrogen dioxides in and near the study area. Because of the tall stacks used at both plants, however, the impact is likely to be greatest outside the study area.

The major sources of conventional air pollutants within and adjacent to the study area are documented in the *Atmospheric Environment* technical paper of this Phase II study. In general, sources in the study area contribute less than one per cent of total emissions of conventional air pollutants in Metro. The greatest single source of air pollution is vehicular traffic in the Gardiner/Lakeshore Corridor, which probably accounts for significant amounts of nitrogen oxides, carbon monoxide, volatile organic compounds, and resuspended dust.

Other sources include trucks carrying lakefill to the Leslie Street Spit — as many as 1,500 move through the area daily — contributing vehicle exhausts and emissions of dust from uncovered loads. Major sources of odours include the Main Sewage Treatment Plant and the two rendering plants. Fugitive emissions of dust and odours likely come from the oil tank farms, scrap metal industries, petroleum processing plants, and bulk storage facilities for aggregates and salt. The *Atmospheric Environment* technical paper in Phase I identified 17 industrial sources of volatile organic compounds.

In addition to those sources already mentioned, chemicals in soil and water can become volatile and escape to the air, and soil particles can become suspended as dust. There is no information available for the study area on the nature and extent of chemicals becoming volatile from surface water. Preliminary modelling of volatilization from soil and groundwater indicates that this is not likely to be a concern for either outdoor or indoor air in the study area. However, volatile chemicals and soil dust may be major sources of pollutants during soil clean-up or when large volumes of soil are exposed to air as part of redevelopment activities.

Although the magnitude of deposition is not clearly understood, pollutants can move out of air and into other media. They may fall out as wet or dry deposition on land and water or be inhaled and entrained in the lungs of terrestrial wildlife and humans. The

amounts of chemicals and particulates inhaled and absorbed by terrestrial biota are likely insignificant in terms of the total amounts present in the environment, but such pathways may be significant to those exposed. (They are discussed later in this chapter, in the section on terrestrial biota.)

Noise is also part of the atmospheric environment. A noise survey undertaken during Phase II of the environmental audit confirms that noise levels in the area exceed the MOE guidelines for outdoor noise in residential areas (i.e., they are, on average, greater than 55 decibels). The survey suggests that noise levels are higher close to the Gardiner/Lakeshore Corridor than in the southern parts of the study area. Comparison of these data with studies conducted in 1977 show that average noise levels have dropped about 15 decibels since that time, probably because noisy industries (such as a car-crushing plant) have moved out of the area, and the number of landings and take-offs at the Toronto Island Airport has decreased.

Noise Exposure Forecasts (NEFs) are mathematical models, generally used to determine land use in the vicinity of airports. They do not indicate real noise levels but are approximate predictors of the psychological response of an affected communities to the level of noise generated by airport activities. NEF modelling has been done on the Island Airport and the results indicate that there should be no adverse noise effects from the

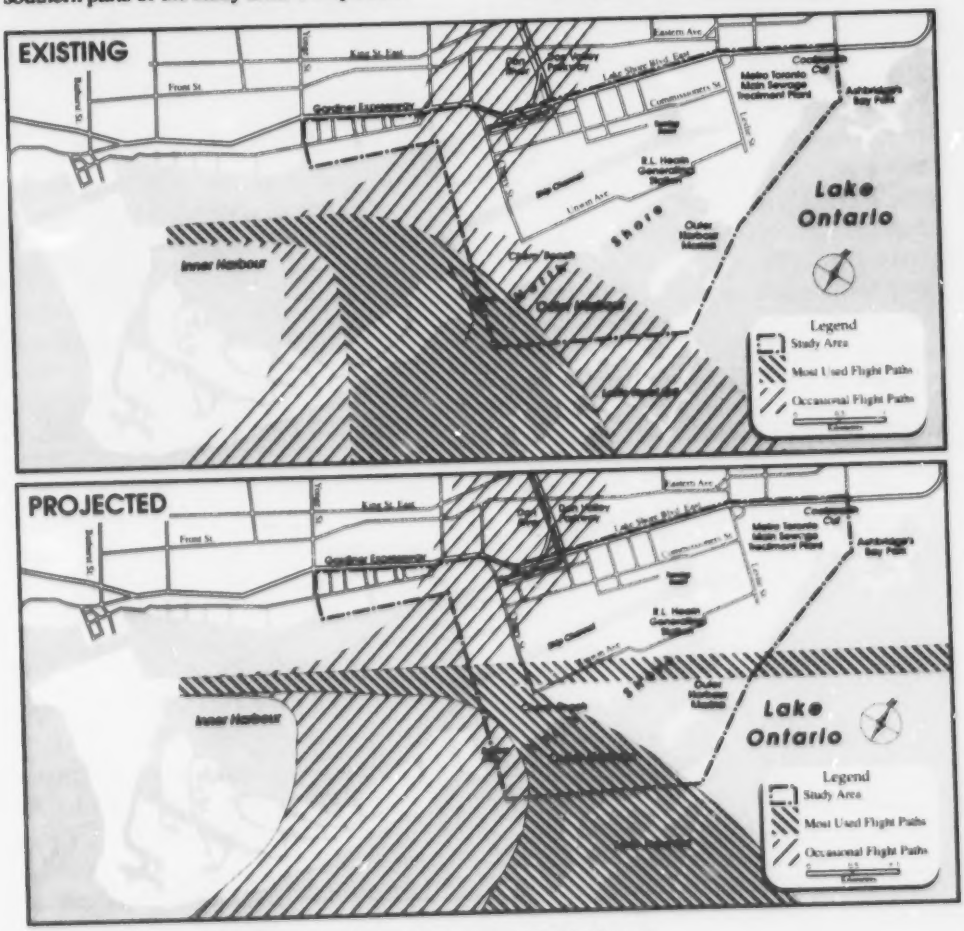


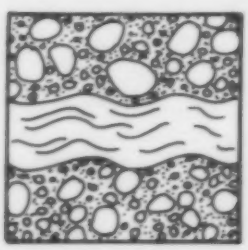
Figure 13 Flight paths to and from the Toronto Island Airport

airport. (See the Royal Commission's report on *The Future of the Toronto Island Airport* for more details on the NEF model).

In reality, however, complaints about airport-related noise have been received from residents in the West Bayfront and from the Toronto Islands, just west of the study area. Between April (when a complaint recording system was initiated) and December 1990, about 500 noise complaints were received by Toronto Island Airport authorities.

The current impact of airport noise on the study area is not known, and several factors are changing the noise conditions. A "good neighbour" policy was implemented in 1990 to encourage pilots to avoid flying over the residential community on the Toronto Island; instead they fly over the Eastern Gap and the south-western corner of the Port Industrial Area. A Microwave Landing System is currently being introduced; this will tend to bring planes in across the Port Industrial Area, especially during bad weather. However, the landing system may allow planes to approach the airport at higher elevations, reducing local noise impacts. Finally, if proposals to increase the number of flights at the Toronto Island Airport are implemented, increases in noise levels may occur.

Soils and Groundwater



Although it is difficult to generalize because types and levels of contamination vary greatly from site to site and across individual sites, studies conducted by the Royal Commission and others on 28 of the 123 sites in the East Bayfront/Port Industrial Area make it clear that the soils and groundwater at some sites are heavily contaminated.

Soil analysis at the 28 locations indicates that, in all but one, levels of inorganic contaminants exceed the Ontario Ministry of the Environment's decommissioning guidelines for residential and parkland uses for at least one parameter, and in most cases for more than one. At 26 of these sites, the guidelines for industrial and commercial uses are also exceeded. The soils contain a wide range of heavy metals, including cadmium, lead, arsenic, mercury, antimony, chromium, and molybdenum. Of the organic compounds, there are provincial clean-up guidelines only for oil and grease, and interim guidelines for PCBs, dioxins, and furans. However, the studies done to date have found many organic compounds in soils, including polycyclic aromatic hydrocarbons (PAHs), benzene, ethylbenzene, toluene, xylene, and PCBs. In some cases, levels of these compounds exceed clean-up criteria developed in other jurisdictions. At some places, organic vapour concentrations were found at levels that indicate an explosion hazard.

Groundwater analyses show that phenols are ubiquitous across the study area. In some boreholes, "free product" (separate phase petroleum products) sits on top of the groundwater. Many heavy metals, and organic compounds such as trichloroethylene, benzene, toluene, and xylene have also been found in groundwater. Levels of contaminants in groundwater at all sites tested exceed the Provincial Water Quality Objectives for at least one parameter, and, in many cases, for more than one.

There are four main sources of nutrient and toxic chemical loading to the soils and groundwater of the study area: atmospheric deposition (discussed previously), lakefilling used to create the area, industrial activities, and decay of terrestrial biota.

It is likely that some of the heterogenous mix of excavation fill, rubble, incinerator ash, garbage, and sand from the lake bottom, used to fill in the Ashbridge's Bay Marsh, was contaminated before it reached the study area. Limited sampling, in areas never used for industry, supports this. Nonetheless, most contaminants come from former and current land uses in the area, and the waste

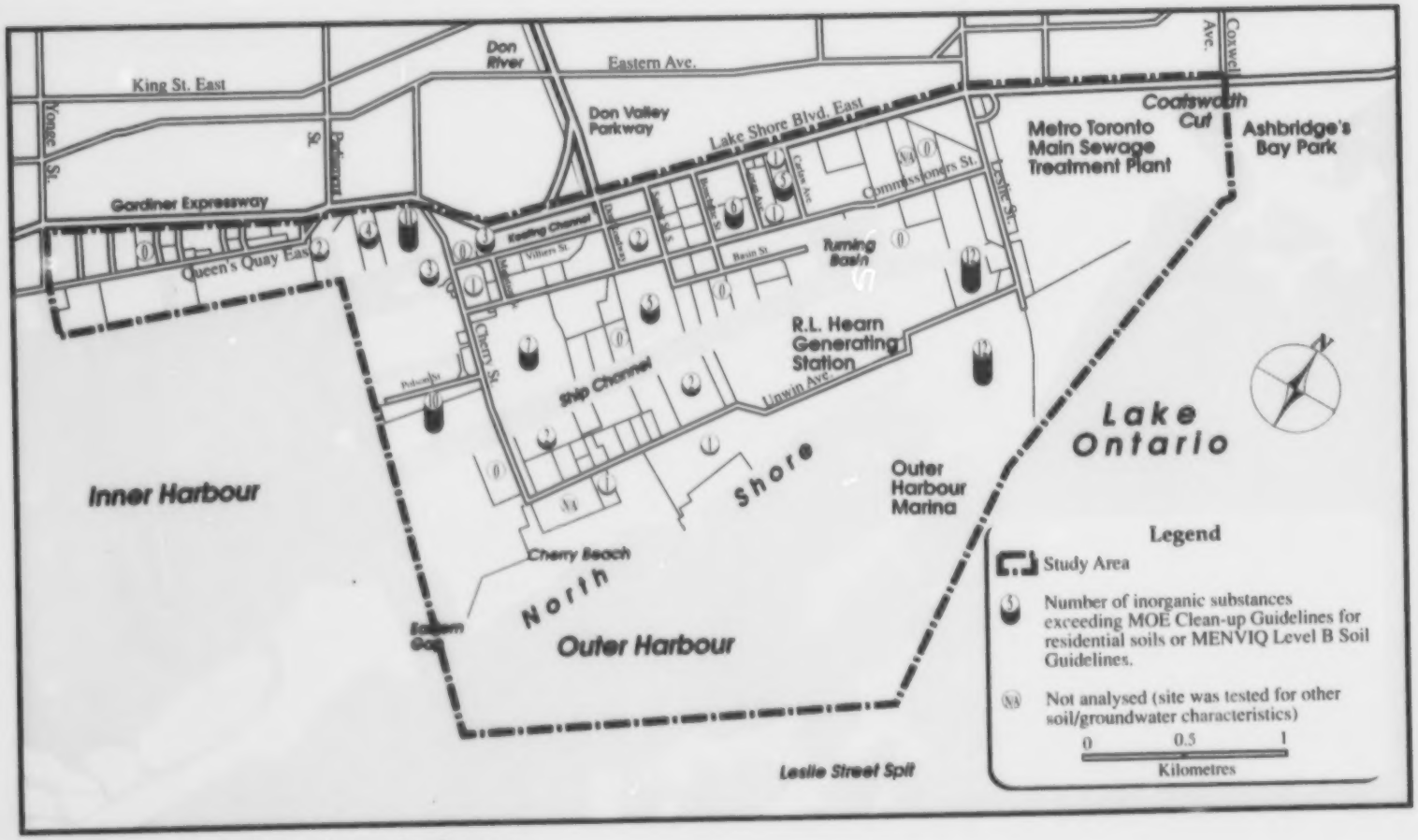


Figure 14 Soil contamination: inorganic substances

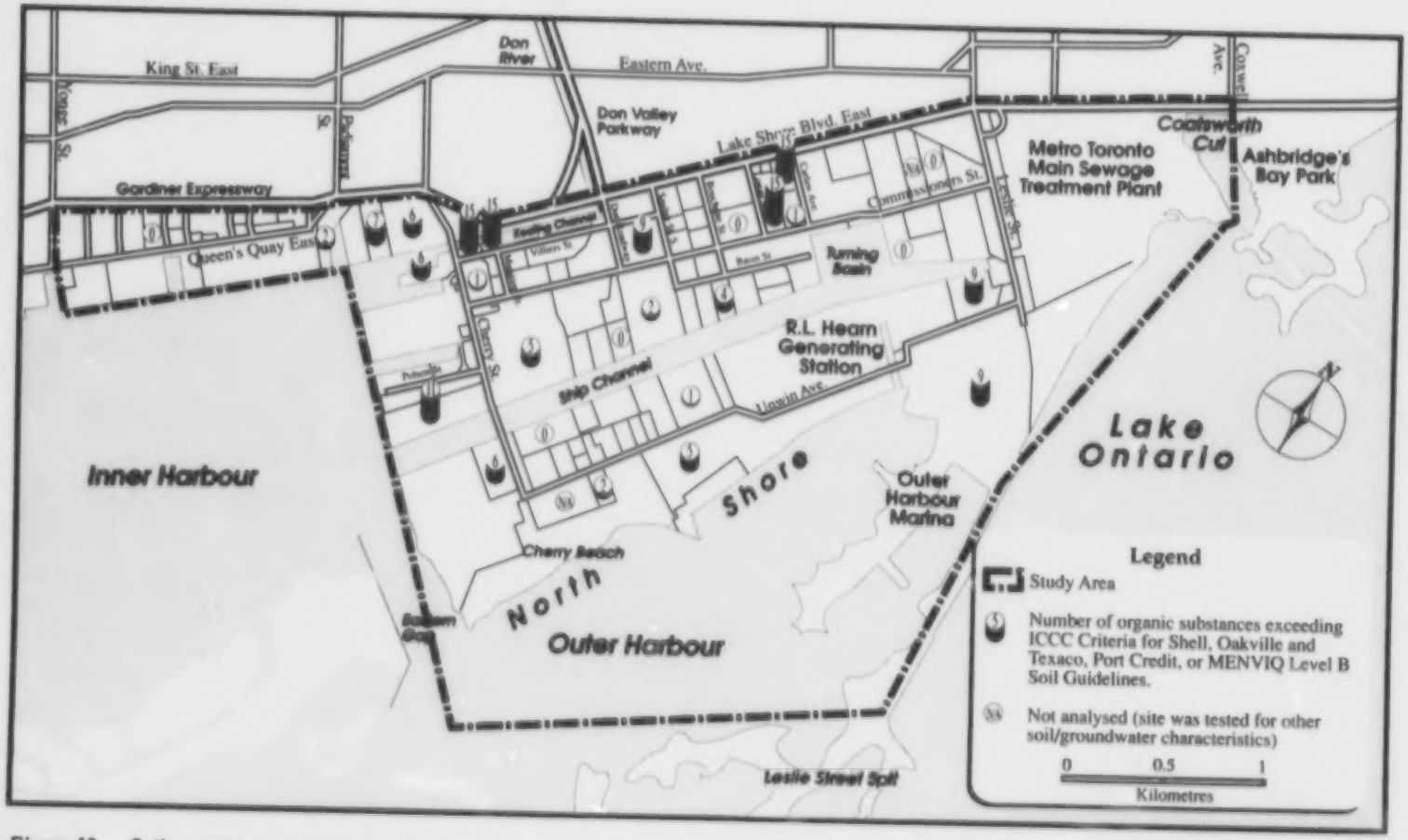


Figure 15 Soil contamination: organic substances

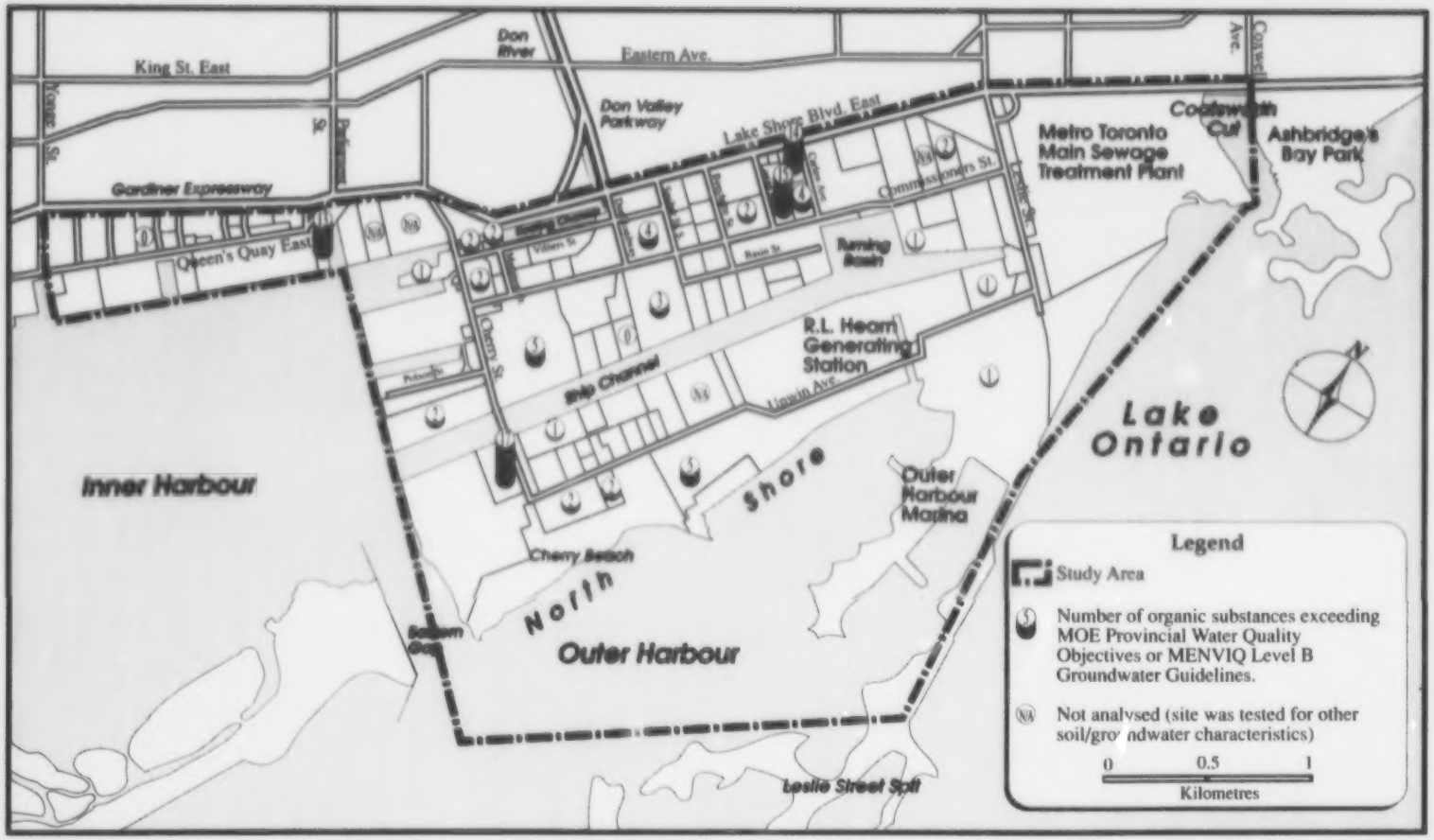


Figure 16 Groundwater contamination: organic substances

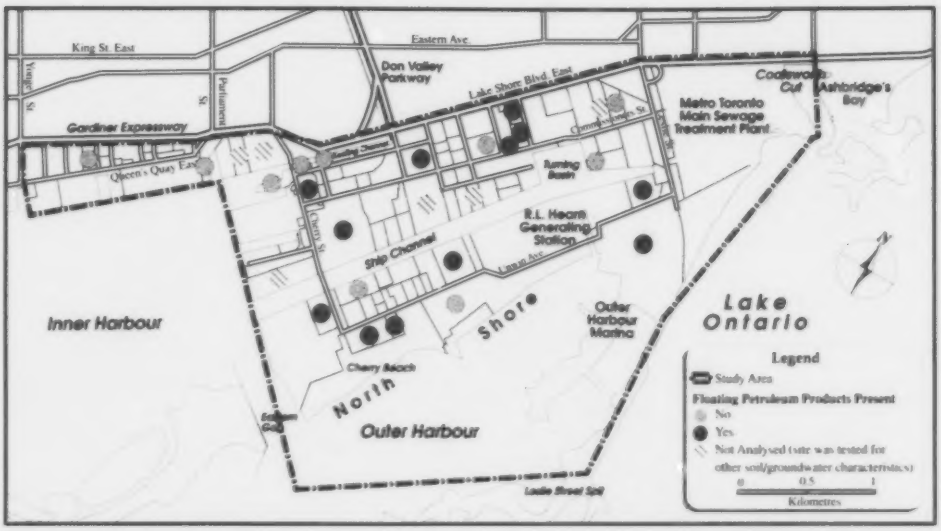


Figure 17 Groundwater contamination: floating petroleum products

dumping, storage, spills, and leaks that result from them. Many of the area industries over the years can be classified as "dirty" and many operated before the dangers of hazardous materials were understood. These industries include petroleum storage and refining, coal storage, metals fabrication and recycling, and tar distillation. In addition, snow dumped from street cleaning by the City has been found to leave depositions of trace metals in the soil.

The audit was able to establish some general relationships between previous land use and contamination of soil and groundwater. On the site of the Commissioners Street Incinerator, elevated levels of cadmium, copper, lead, mercury, molybdenum, and zinc were found in the soil, and elevated levels of lead and zinc in the groundwater. This contamination is probably related to deposition of airborne particles from the incinerator stack or the way incinerator ash was handled at the site. Former storage facilities for road salt show elevated levels of sodium adsorption ratio and conductivity in soil, and sodium and chloride in groundwater. At three locations where bulk storage of coal formerly took place, elevated levels of arsenic — a trace element in coal — were found in the soil. Its presence may be caused by residual coal dust, or coal fragments still present in the soil.

The decay of terrestrial plants and animals can contribute nutrients and toxic chemicals to soils and groundwater, and is an important component of ecosystem cycling. However, there are no data available on the magnitude of this source for either the study area or anywhere else.

Transfers are taking place in the soils and groundwater of the study area, with the contaminants adsorbed to soil particles slowly moving into groundwater, and migration of contaminated groundwater between sites.

Pollutants are also moving out of the soils and groundwater as the result of four processes: ingestion or uptake by terrestrial biota; volatilization to air; resuspension of dust; and movement of groundwater to surface waters.

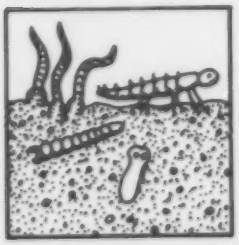
Plants can take up nutrients and some soluble contaminants through their roots. Because most information on uptake of contaminants by plants deals with food crops, little is known about the plant species found in the study area. Some analysis has been carried out by the City of Toronto on soil in the Victory allotment gardens near Leslie

Street. The limited data show no exceedances of clean-up guidelines for lead, mercury or cadmium in the soil being used to grow vegetables and fruit.

Animals and humans may also be exposed to toxic chemicals when they inhale dust or vapours, or ingest soil. This can be especially important for young children: it is estimated that, between the ages of 18 months and three-and-a-half years, a child may ingest as much as 10 grams a day in normal play and mouthing activities. In this regard, the levels of lead in soil near the Gardiner and in the east end of the study area (close to Canada Metals) could be a future problem, depending on land use. This pathway may also be important in the parkland of the north shore, in any areas where soil is bare of vegetation and accessible to human contact.

Because of the contaminated soils in the study area, volatilization to air and resuspension of dust are likely to be important pathways, especially during clean-up or redevelopment, when large volumes of soil will be exposed to the air.

Sediments



Although contamination of bottom sediments in the study area varies somewhat, sediments in all areas — the Keating and Ship channels, the Inner and Outer harbours, and Ashbridge's Bay — exceed the provincial Open Water Disposal Guidelines for at least seven parameters. (Such sediments cannot be placed in surface waters, and require disposal in a confined disposal facility). The sediments of the Keating Channel contain the highest levels of total organic carbon, manganese, and lead, while those in the Ship Channel contain the highest levels of cadmium and zinc. The highest levels of copper are found in the Inner Harbour sediments, and those of Ashbridge's Bay contain the highest levels of aluminum, arsenic, chromium, iron, and nickel (see Figure 18).

There are many sources of contaminants and nutrients in bottom sediments, including natural coastal processes; storm sewers and combined sewer overflows; the Don River; discharges from the Main Sewage Treatment Plant; deposition from surface waters; lakefilling activities; and the decay of aquatic biota.

Natural coastal processes, especially erosion from the Scarborough Bluffs, have historically laid down sediments and were responsible for the creation of the Toronto Islands. Such sources generate relatively uncontaminated, nutrient-poor sediments. By contrast, anthropogenic sources are often heavily contaminated.

The greatest source in the study area comes from discharges from the Don River: as the Don makes its right-hand turn into the Keating Channel, much of its sediment load (a great deal of which originates in the headwaters of the Don) is dropped into the channel. The volume of sediment deposited makes it necessary to dredge the channel annually to make it navigable and to reduce the risk of flooding in the Lower Don floodplain.

Storm sewers and combined sewer overflows contribute to sediment degradation along the nearshore of Lake Ontario, while effluent from the Main Sewage Treatment Plant has impaired the sediment around its outfall pipe.

Unfortunately, there are no data on the loadings of contaminants and nutrients to the sediments in the study area, and limited data on loadings of sediments themselves. Although estimates of projected loadings from the Don River were prepared as part of the 1983 *Keating Channel Environmental Assessment*, they are unlikely to be accurate now because of the recent development

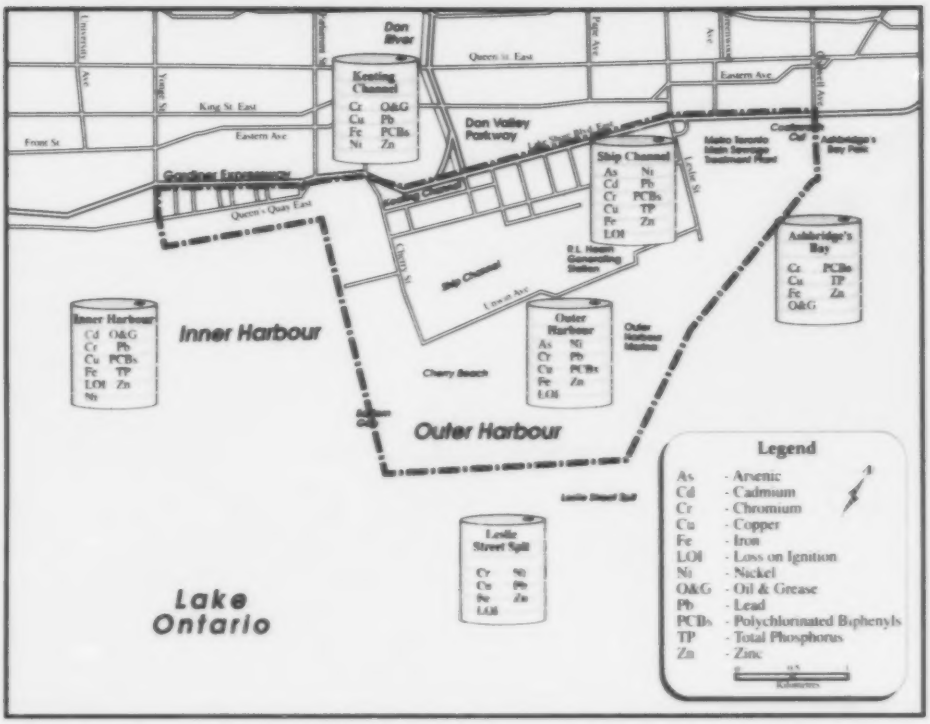


Figure 18 Sediments: parameters exceeding the Provincial Open Water Disposal Guidelines

boom in York Region.

Contaminants, whether adsorbed to sediments or dissolved in the water, can be transported by waves and currents. Because the Inner Harbour is relatively sheltered and water circulation is poor, this may not occur to a great extent. If the Hearn Generating Station is restarted, increased circulation from its cooling waters may affect the movement of sediments in the Outer Harbour. Sediment movement also occurs during dredging and lakefilling activities, but it is not known to what extent. Dredging interferes with the process by which sediments, if undisturbed, naturally become buried over time as new sediments settle.

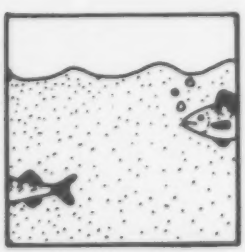
There are a number of routes by which contaminants can be lost from sediments. These include resuspension into the water, and ingestion or uptake by aquatic biota. Dredging and lakefilling can cause resuspension; although there are no data on resuspension due to wave action, it does occur in exposed, eroded areas like the Eastern Beaches. Studies on lakefilling and dredging indicate that impairment of water quality during such activities is localized and relatively brief.

Among the aquatic biota that can ingest contaminants and nutrients associated with suspended and bottom sediments are benthic (bottom-dwelling) organisms, zooplankton, algae, and fish. Contaminant uptake is complex, and depends on many factors including the type of contaminant, the size of sediment particles, and the organism. For example, most metals (except iron and manganese) are tightly bound to nutrient-rich sediment particles (such as are found in the Keating Channel), and, therefore, are not readily available to plants or animals. The limited available data suggest that benthic organisms in the study area are not bioaccumulating metals to a significant degree. How-

ever, these organisms do appear to bioaccumulate significant levels of some organic compounds — chlordane and HCB in the Keating Channel and Inner Harbour, a metabolite of DDT in the Inner Harbour, and PCBs in Ashbridge's Bay. The Metropolitan Toronto and Region Conservation Authority's (MTRCA's) recent monitoring near the Outer Harbour Marina, using caged clams, suggests that mercury is being bioaccumulated. The effects of this bioaccumulation on the health of biotic communities or individuals are not known.

Information on the impact of contaminated sediments on aquatic biota is sadly lacking, for the study area and for the Great Lakes generally. However, the provincial Ministry of the Environment (MOE) is carrying out a pilot program at the Main Sewage Treatment Plant, which includes studying the effects of contaminated bottom sediments on aquatic biota. Improved guidelines on sediment quality and guidelines to protect aquatic biota from pollutants are also being developed by MOE.

Surface Waters



Water quality in the study area is poor and characterized by high levels of nutrients, with the Inner Harbour bordering on a eutrophic state, and the Keating Channel already eutrophic. Although phosphorus levels across the waterfront have dropped considerably over the last 15 years, they exceed Provincial Water Quality Objectives. The waters in the Keating Channel frequently exceed provincial objectives for levels of copper, iron, lead, and zinc, and the objectives are occasionally exceeded in the Inner Harbour. Objectives for copper and iron are exceeded occasionally in the Outer Harbour. There are limited data on levels of organic chemicals in the waters of the study area.

The bacterial water quality at Toronto's swimming beaches is monitored every summer by the City's Department of Public Health; the monitoring shows that Cherry Beach on the north shore of the Outer Harbour is consistently one of the cleanest beaches on the waterfront. However, it appears that the number of days on which Toronto's beaches are "posted" as the result of high bacteria levels has been increasing over the past three years and, in the summer of 1990, Cherry Beach was posted for the first time since 1987. A City investigation, carried out in the summer of 1990, confirmed a decrease in the use of Cherry Beach, an increase in anecdotal health-related complaints, and an increase in reported sightings of raw sewage and algal growth.

The sources of contaminants and nutrients in surface waters in the study area include storm and combined sewers, the Don River, the Main Sewage Treatment Plant (STP), sediments, atmospheric deposition, decay of biota, and infiltration of contaminated groundwater. The Don River is the major conduit of nutrients to the surface waters of the study area; the Main STP, the major conduit of organic chemicals. Most of the sources originate outside the study area. The organic chemicals passing through the Main STP, for example, come from the approximately 400,000 residences and hundreds of industries in the Main's "sewershed".

In general, there are gaps in our understanding of sources: the lack of knowledge about resuspension from sediments is a good example. Nor is the contribution of chemicals and metals from combined and storm sewers in the study area known. There are only preliminary estimates of atmospheric deposition.

There are three pathways by which nutrients and contaminants can be lost from surface water: they can be removed from the water column by settling into bottom sediments or can volatilize to air, but there is little

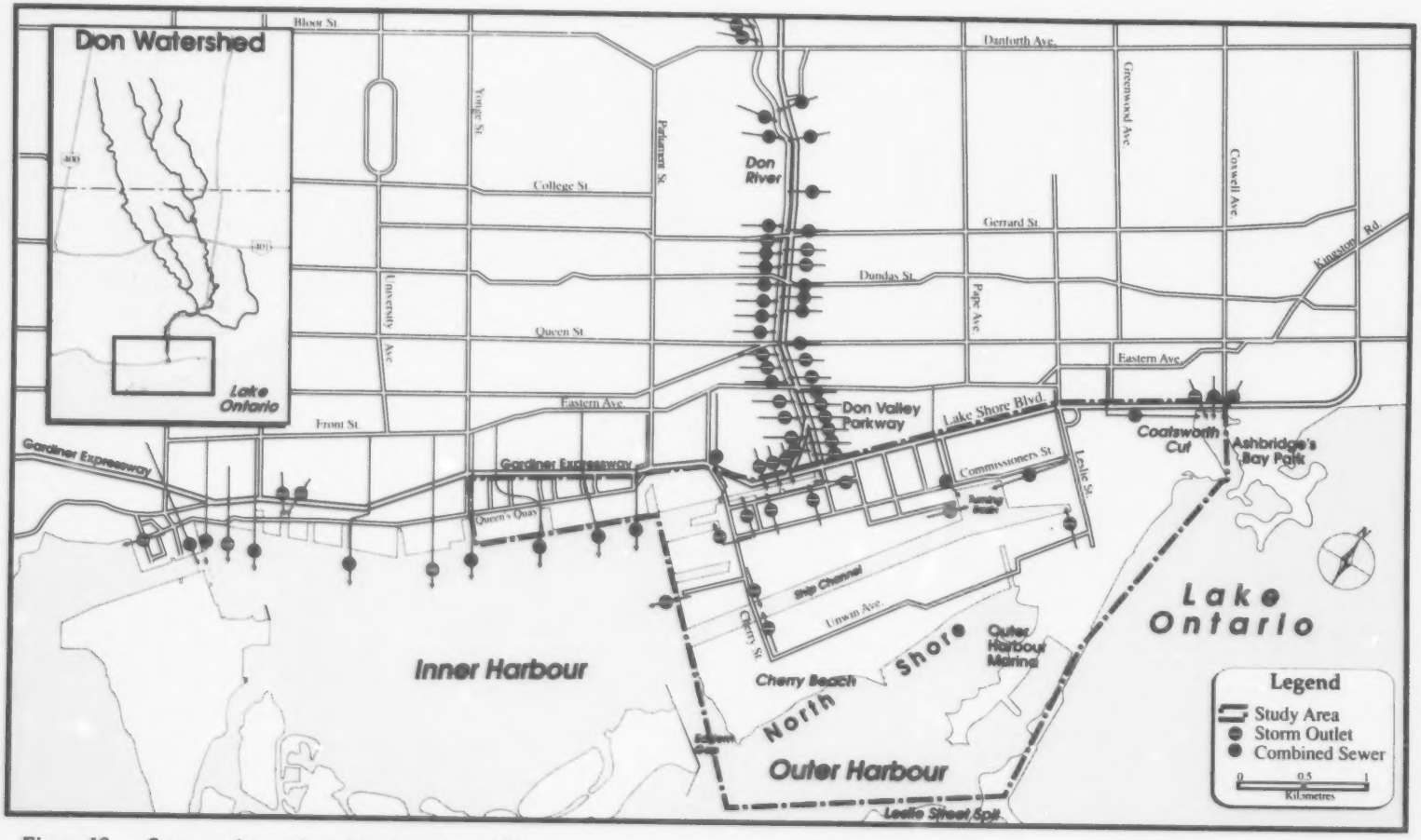
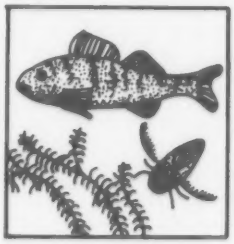


Figure 19 *Storm outlets and combined sewer outfalls*

or no information on the importance of these processes. Finally, like humans, aquatic biota can take up or ingest nutrients and contaminants. Exposure to bacteria while swimming or windsurfing in surface waters can cause gastrointestinal illness as well as skin, ear, nose, eye, and throat infections.

Aquatic Biota



Plants and animals dependent on the aquatic food webs in the study area include benthic invertebrates, algae and other aquatic plants, zooplankton, fish, and aquatic birds. Little or no information exists on the status of zooplankton and algal communities in the study area. Despite the nutrient-rich growing conditions, growth of algae has generally not been a nuisance in past years, probably because of wave action, high levels of turbidity that prevent sunlight from penetrating the water, and the limited substrates available for attachment of rooted plants. However, in the summer of 1990 this was not true in the Outer Harbour, where, according to the City of Toronto Department of Health, there were higher than usual sightings of algae by people using the water.

The community structure of benthic organisms is widely used as an indicator of water and sediment quality in fresh-water systems because the diversity and types of benthic life reflects the levels of contaminants present. In highly contaminated areas, such as the Keating Channel or the dredgeate disposal cells on the Leslie Street Spit, there is a low diversity of species, and these tend to be of the pollution-tolerant variety. The number of species increases in the deeper, less contaminated open waters of the study area.

Fish populations and their habitats in the study area have been investigated by the Royal Commission, the Ministry of Natural Resources, and the Metropolitan Toronto and Region Conservation Authority (MTRCA). Species diversity generally reflects the relative quality of habitat. In the Lower Don, the Keating Channel, and the Ship Channel, poor water quality, dredging, and concrete retaining walls make poor habitat for fish. The best habitat in and near the study area lies in the Outer Harbour near the Hearn outfall, and in the embayments at Ashbridge's Bay and the Leslie Street Spit. Embayments provide shelter for warm-water species from the periodic upwellings of cold water that occur in the lake, lowering temperatures drastically. The north shore of Lake Ontario, generally bereft of the protection once afforded by its rivermouth marshes, is a fairly hostile environment for warm-water fish.

The best fish community in the study area is in the shallow zone along the north shore of the Outer Harbour; it provides good thermal protection and spawning habitat. In contrast, the fish communities in the Keating and Ship channels have the lowest diversity. Coatsworth Cut, which is generally a good fish habitat area, is adversely affected by occasional bypasses of chlorinated, treated effluent from the Main Sewage Treatment Plant. An angler survey of the Outer Harbour and Ashbridge's Bay, carried out by the Royal Commission, showed a surprising number of anglers (71 people over 9.5 days during July 1990) and a very small rate of return. In Ashbridge's Bay, one fish (a carp) was caught after a total of 64 hours of fishing. The success rate in the Outer Harbour was somewhat better: four carp were caught after 60 hours of effort. Of all the waters in the study area, the north shore of the Outer Harbour has the best potential for the creation of significant habitat and the subsequent establishment of a stable fish community.

Levels of contaminants in fish are determined under the Ministry of the Environ-

Table 2 Fish Species Associated with Habitat Types in the Port Industrial/East Bayfront Area and Neighbouring Areas

Species	Channel Habitat §	Outer Harbour π	Embayment Habitat ¥	Classification *
Sea Lamprey			Δ	Pa C
Alewife	Δ	Δ	Δ	F I W
Gizzard Shad	Δ	Δ	Δ	Co F W
Lake Whitefish			Δ	C
Coho Salmon			Δ	P I S C
Chinook Salmon			Δ	P I S C
Round Whitefish			Δ	C
Rainbow Trout			Δ	P I C
Brown Trout			Δ	P I C
Lake Trout			Δ	P R S C
Rainbow Smelt	Δ	Δ	Δ	F I C
Northern Pike	Δ	Δ	Δ	P W
Goldfish			Δ	Co I O W
Carp	Δ	Δ	Δ	Co O W
Golden Shiner			Δ	F W
Emerald Shiner	Δ	Δ	Δ	F W
Common Shiner		Δ	Δ	F W
Spottail Shiner	Δ	Δ	Δ	F W
Spotfin Shiner			Δ	F W
Bluntnose Minnow		Δ	Δ	F W
Fathead Minnow			Δ	F W
Longnose Dace			Δ	F W
Creek Chub			Δ	F W
White Sucker	Δ	Δ	Δ	Co F W
Shorthead Redhorse			Δ	Co F W
Brown Bullhead			Δ	Co O W
American Eel	Δ		Δ	F W
Brook Stickleback			Δ	F W
Threespine Stickleback			Δ	F W
Trout-Perch			Δ	F W
White Perch	Δ		Δ	P I W
White Bass			Δ	P W
Rock Bass		Δ	Δ	P F W
Pumpkinseed	Δ	Δ	Δ	P F W
Bluegill			Δ	P F W
Smallmouth Bass			Δ	P W
Largemouth Bass			Δ	P W
Black Crappie			Δ	P W
Johnny Darter		Δ	Δ	P W
Yellow Perch	Δ	Δ	Δ	P F W
Freshwater Drum			Δ	Co P W
Mottled Sculpin		Δ	Δ	F C
Total Number of Species	**11**	**15**	**42**	**42**

Sources and Symbols:

§ Channel habitat includes Keating Channel, Ship Channel and Ship Turning Basin.
¥ Embayment habitat includes Coatsworth Cut (in East Bayfront/Port Industrial Area), and Ashbridge's Bay and Leslie Street Spit (adjacent to study area).
* C coldwater, W warmwater, F forage, Co coarse, P predator, O omnivore, Pa parasite, I introduced, R original population lost but has been reintroduced, S populations maintained by stocking.
Source: MNR 1990 unpublished (includes summer season only), MNR 1989, MTRCA 1990, 1989.
π Data collected during summer 1990 by MTRCA.

ment's Nearshore Juvenile Fish Contaminants Surveillance Program and its Sport Fish Contaminant Monitoring Program. These indicate that levels of many contaminants, including PCBs, DDT and its metabolites, BHC and chlordane, have been decreasing over the last decade, although they can still be detected. Fish consumption advisories have been issued for certain sizes of eight species in the study area, because they contain high levels of mercury, mirex, and PCBs.

Research undertaken by the Canadian Wildlife Service of Environment Canada has provided a great deal of information on contaminant levels in eight species of Great Lakes birds that depend on the aquatic food webs. Of these species, one is abundant in the study area (ring-billed gull); five are common (double-crested cormorant, black-crowned night heron, herring gull, caspian tern, and common tern); and two are rare (bald eagle and Forster's tern). Populations of all these fish-eating birds declined severely in the early 1970s. In the mid to late 1970s, the population of cormorants, for example, decreased to only three pairs in Lake Ontario. The population decreases were caused by eggshell-thinning and embryonic mortality due to exposure to metabolites of DDT.

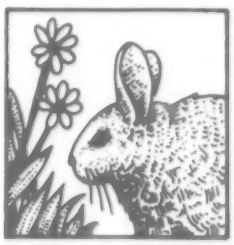
After DDT was banned in the late 1970s, populations of these birds began to recover slowly. While these birds are now able to survive, they are still showing effects of persistent chemical contaminants. As the number of cormorants increases around the Great Lakes, deformities in the birds are being observed, including club feet, crossed bills, and eye and skeletal malformations.

There are no data available on the levels or effects of contaminants in aquatic bird populations in the East Bayfront/Port Industrial Area. However, data exist for gulls on the Leslie Street Spit, and for birds at Mugg's Island, which is at the western end of the Inner Harbour. Levels of contaminants there have been measured in herring gull eggs since 1974. Levels of DDE, mirex, HCB, and PCBs have decreased significantly, but levels of dieldrin and 2,3,7,8-TCDD (the most toxic form of dioxin) have remained approximately the same. Deformities include leg abnormalities in ring-billed gulls, and crossed bills in common tern chicks.

Loadings of contaminants to aquatic biota occur through ingestion, and uptake from water and sediments. Benthic organisms, attached algae, some zooplankton, and bottom-feeding fish are likely to receive the majority of their loadings from sediments. In addition to food sources, gill transfer is probably an important exposure pathway in fish because, while concentrations of toxic chemicals in water may be low, large volumes of water flow over fish gills. Ingestion of fish is the major route of exposure for aquatic birds.

There are three main pathways by which contaminants and nutrients can be lost from aquatic biota: ingestion of aquatic biota by terrestrial biota; decay to surface water and sediments; and excretion. Ingestion by terrestrial biota (which is discussed in the next section) is an important route of exposure; decay of aquatic biota may be an important pathway, but has not been studied extensively; it is unlikely that excretion is a major pathway.

Terrestrial Biota



The major types of terrestrial biota in the study area are plants, invertebrates, reptiles and amphibians, birds (except those that depend on the previously discussed aquatic food sources), and mammals. The variety of habitats available for terrestrial biota are described in Chapter 2. Due mostly to benign neglect, the natural

processes of succession have left the East Bayfront/Port Industrial Area with a varied and rich mosaic of habitats, although, in general, links between the various habitats are poor.

The work of the Royal Commission has shown that the East Bayfront/Port Industrial Area supports a remarkable number of wildlife species. A total of 330 species of plants have been recorded, including 12 that are regionally or provincially rare, and there have been 260 recorded species of birds, 12 species of mammals, two of amphibians, one snake species, and 27 species of butterflies.

There is no information on the levels or effects of contaminants in plants, invertebrates, reptiles, amphibians, mammals or terrestrial birds in the study area.

Although little is known about the magnitude at which it occurs, it is recognized that plants are exposed to nutrients and toxic chemicals through atmospheric deposition and by uptake from groundwater.

Animals are exposed through food, air, and water, as well as through the previously described ingestion of soil and inhalation of dust in air. Non-human biota will likely obtain their drinking water from puddles and the nearshore areas of the lake. Terrestrial biota that eat fish and other aquatic biota (such as raccoons) are likely to be exposed to significant numbers of contaminants by doing so.

It has been estimated that the major route of exposure to persistent organochlorines for humans — who are also terrestrial biota — is through food, which accounts for approximately 85 per cent of total exposure. Drinking water and air are less direct routes of exposure (representing approximately 10 per cent and five per cent respectively). However, air is a critical pathway for pollutants: a great proportion of the contaminants that end up in food or drinking water pass through the air before reaching them.

At least in theory, eating fish caught in the East Bayfront/Port Industrial Area is the most important route by which humans are exposed to toxic chemicals there. However, the angler survey conducted by the Royal Commission at Ashbridge's Bay and in the Outer Harbour found that 42 of the 50 anglers interviewed, or 84 per cent, would not eat any fish caught there, while the rest said they would occasionally eat fish caught there. Somewhat disturbingly, fewer than half of those interviewed were aware of the *Guide to Eating Ontario Sportfish*, which advises anglers about levels of toxic contaminants in sportfish.

Evaluation of Ecosystem Health

Thus far, we have examined the structures (habitats) in the study area, and how the ecosystem functions. But the outstanding question remains: is the East Bayfront/Port Industrial Area ecosystem healthy?

Human health has been defined by the World Health Organization Regional Office for Europe as:

> the extent to which an individual or group is able, on the one hand, to realize aspirations and satisfy needs, and, on the other hand, to change or cope with the environment. Health is therefore seen as a resource for everyday living, not the objective of living. It is a positive concept emphasizing social and personal resources as well as physical capacity.

This broad definition is the foundation for the concept of healthy cities described in the first chapter of this report. It recognizes that the health of city dwellers depends on all aspects of the urban ecosystem: social, economic, and physical. Thus, health needs should not be seen as the exclusive domain of the public health care system, but should be considered in all areas of jurisdiction,

including economic development, transportation, public works, environmental protection, parks, recreation, social services, education, and housing.

Traditionally, concepts of health have been applied to individual people and human populations, and to other animals, such as domesticated farm animals and pets or wildlife, particularly those valued in hunting or fishing. Only recently has attention been paid to the evaluation of ecosystem health. Three basic approaches have been used:

- identifying and measuring stressors on the ecosystem;
- identifying and measuring characteristics that distinguish healthy ecosystems from unhealthy ones;
- assessing the status of components of the ecosystem.

A recent assessment of ecosystem health in the Great Lakes Basin is included in *Great Lakes, Great Legacy?* (published by the U.S. Conservation Foundation and the Canadian Institute for Research on Public Policy). It summarizes the trends and status in 15 indicators of ecosystem health, including environmental contaminants (air, surface water, sediments, and groundwater), fish and wildlife characteristics (contaminant levels, populations, habitat, fisheries), terrestrial conditions (forests, wetlands, soil, agriculture, shorelines), and human conditions (health, economics).

Other examples of efforts to assess ecosystem health include *An Ecosystem Approach to the Integrity of the Great Lakes in Turbulent Times*, edited by Edwards and Regier (1990), and Rapport's *Challenges in the Detection and Diagnosis of Pathological Changes in Aquatic Ecosystems* (in press). These works grapple with the problems of defining ecosystem health, and diagnosing unhealthy ecosystems.

The use of indicators to help assess conditions is common in our society: temperature, humidity, and wind speed are used to make a snapshot of the weather; body temperature is important evidence of overall human health; the unemployment rate, interest rates, and the consumer price index give some idea of the condition of the economy.

But there are few indicators to help scientists and regulators assess the health of an ecosystem. Historically, in fact, many discoveries of distress or collapse were the result of chance. Thomas Kuchenberg refers to Harold Harvey's discovery of "dwarf" suckers in Lumsden Lake near Killarney Provincial Park in 1965 as just such a chance observation. Harvey's findings led ultimately to the understanding of acid rain and its devastating effects on northern Canadian lakes. Kuchenberg states:

> The change in fish population was not without precedent. Scientists were aware of other events in different places that had been the first indication of an environmental crisis: sick cats signalled mercury poisoning in Japan; vanished mayflies denoted eutrophication in Lake Erie; and eggshells so soft they could be dented by a simple touch led to discoveries of dioxin in the Great Lakes.

Today, scientists who search for indicators of ecosystem ill health are attempting to remove that reliance on chance, to develop early-warning systems so that "ecosystem distress syndrome" can be avoided through early diagnosis, when the "patient" is more easily treated.

Recognizing that humans are an integral part of many ecosystems, any assessment of ecosystem health needs to encompass human health as well as that of wildlife (plants and animals), and air, land, and water. This means that observers must try to look at the ecosystem from both a human perspective and a biocentric point of view. For example, in evaluating habitats, the

human-centred perspective might lead to the question: are there sufficient, high-quality habitats to provide opportunities for a range of recreational activities? On the other hand, the biocentric viewpoint might lead to the question of whether the same habitats could support the variety and quantity of wildlife expected for a particular bioregion.

These two perspectives may sometimes come into conflict — for example, when overuse or misuse of a park or reserve by humans threatens the integrity of habitats for wildlife. In such cases, an ecosystem approach clarifies the existence of these conflicts and provides a basis on which the application of management values can be discussed.

In order to select criteria applicable to the study area and the work of the environmental audit, a review was undertaken of criteria and indicators used in other contexts, including the healthy cities concept; *Great Lakes, Great Legacy?*; *Great Lakes Water Quality Agreement*; the principles set out in *Watershed*; as well as the technical paper on *Ecosystem Health: A Biophysical Perspective*, which was prepared for Phase II of the audit. The conclusion was that criteria should:

- help answer the questions posed to the audit team;
- be feasible using the existing information base; and
- be appropriate for the East Bayfront/Port Industrial Area.

Based on that review, it was decided that the ecosystem health in the East Bayfront/Port Industrial Area would be assessed on the basis of:

1. habitat diversity, quantity, connectedness, and quality for wildlife;
2. diversity and abundance of wildlife species;
3. complexity of the food web;
4. the presence or absence of species of plants and animals introduced into the area, and their effect on it;

Bird watchers

5. adequate reserve of nutrients circulating through the ecosystem with no artificial additions or removals;
6. levels of toxic chemicals in the ecosystem;
7. effects of toxic chemicals on humans and wildlife;
8. levels of dust, odours, and noise;
9. variety, quality, and accessibility of opportunities for human activities;
10. safety from environmental hazards;
11. connectedness with the past (cultural and biological heritage);
12. aesthetics (urban form, perception of clean environment, natural features).

The criteria have been measured against appropriate guidelines, objectives, and standards, where they exist. Where they do not, professional judgement has been used in evaluation.

Several of the above criteria are based on the concept of stressors on the ecosystem (factors such as the presence of toxic chemicals or introduced species). Some are based on measuring the effects of stressors (for example, the amount and quality of wildlife habitat, species diversity or birth defects). Still others are based on human perceptions of ecosystem health (such as aesthetics). The indicators selected reflect both human and non-human needs.

Evaluation of Ecosystem Health in the East Bayfront/ Port Industrial Area

1. Habitat diversity, quantity, connectedness, and quality for wildlife

The East Bayfront/Port Industrial Area includes a wide variety of terrestrial habitats, but only a limited diversity of aquatic ones. The number and quality of habitats vary across the area: good-quality terrestrial habitats are concentrated along the north shore of the Outer Harbour, and scattered in the Port District on vacant lots. Connections with the Leslie Street Spit are fairly good, whereas connections with the Don Valley are very poor.

The boat slips and channels provide highly degraded and limited aquatic habitat. The aquatic habitat of the Outer Harbour is similar to many areas on the Toronto waterfront: limited structural habitat and exposure to periodic upwellings of cold water. The embayments of the Outer Harbour Marina and Coatsworth Cut provide thermal refuges from rapid temperature changes in the lake. However, the habitat value of Coatsworth Cut is reduced by occasional inputs of chlorinated, treated effluent from the Main Sewage Treatment Plant. The nearby habitats of the Toronto Islands, Leslie Street Spit, and Ashbridge's Bay Park offer supplementary habitat opportunities (weed beds, structural features, spawning habitat, thermal refuges) for fish in the area.

2. Diversity and abundance of wildlife species

The terrestrial habitats of the East Bayfront/Port Industrial Area support diverse plant species, including a number of provincial and regional rarities, but few species of small mammals, reptiles, and amphibians. There are many species of butterflies and moths, and probably of other invertebrates, particularly in the open field and scrub habitats.

There are few aquatic species in the study area — which is true of much of the Toronto waterfront, excepting the lakefill embayments and remaining natural rivermouths such as the Rouge.

Although the diversity and abundance of birds in the East Bayfront/Port Industrial Area has declined since the days of the Ashbridge's Bay wetland, there are still remarkably high numbers of species — some 260 were recorded between 1970 and 1990. Dur-

ing the spring and fall migrations, many of these birds stop in the north shore area and the lagoons of the sewage treatment plant to rest and feed. Others live in the area for all or part of the year: 27 species have been observed nesting in the study area, and 16 species overwintering. The great diversity of birds probably reflects several factors:

- a combination of terrestrial and aquatic habitats;
- the fact that the waterfront location is a crucial migration stopover before or after the lake crossing;
- the vital, if fragmented, connection for wildlife movement formed by the Toronto Islands, Leslie Street Spit, and Don Valley;
- the fact that the good-quality habitats are virtually unmanaged and not excessively disrupted by human activity.

3. Complexity of the food web

The quality of the terrestrial food web varies in different parts of the East Bayfront/Port Industrial Area: the north shore of the Outer Harbour provides the best food web, with many trophic (i.e., feeding) levels. Plant life is diverse and abundant and there is a variety of invertebrates that provide food for reptiles, amphibians, birds, and small mammals. Upper trophic-level predators include owls, hawks, kestrels, cats, and probably foxes. Other parts of the study area have very impoverished food webs, based on a few species typical of a stressed urban ecosystem: sparrows, starlings, house mice, rats, and raccoons.

The aquatic food web of the Outer Harbour and boat channels is limited in species, while the embayments have much higher diversity. A number of predator species are present: in the Outer Harbour, these include Northern pike, rock bass, pumpkinseed, yellow perch, and probably brown trout and salmon.

4. Presence/absence and effects of introduced species of plants and animals

There are many non-native species that have been introduced, deliberately or inadvertently, into ecosystems. Such species frequently disrupt the food web, displace native species, and alter habitat. Over the last century, many aquatic species have been introduced into the Great Lakes, including several found in the study area — the sea lamprey (a devastating parasite on other fish), alewife, rainbow smelt, carp, and, most recently, the zebra mussel. In combination with overfishing and environmental degradation, the sea lamprey, alewife, smelt, and carp have had dramatic effects on the composition and abundance of species in the Great Lakes. The tiny zebra mussel is the newest scourge to invade the Great Lakes, blanketing fish-spawning habitat, eating vast

Zebra mussels

quantities of plankton, coating boats, and blocking water intake pipes.

Purple loosestrife is to wetlands what the zebra mussel is to rivers and lakes: an insidious, prolific, and virtually indestructible threat. Its beauty — lovely drifts of purple flowers from mid-summer to fall — masks its power to displace other plant species, creating a monoculture that is useless to most wetland creatures. At present, there are small stands of purple loosestrife in most of the marshy areas in the study area.

Among the avian residents of the East Bayfront/Port Industrial Area, the rock dove, starling, house sparrow, and house finch are non-natives. All are associated more with urban habitats (built and manicured areas) than with more natural ones.

5. Adequate reserve of nutrients with no artificial additions or removals

The aquatic ecosystem of the East Bayfront/Port Industrial Area is characterized by high levels of nutrients: amounts of phosphorus across the waterfront often exceed the Provincial Water Quality Objectives. Within the study area, the boat slips, the channels, and Coatsworth Cut are considered eutrophic (having high nutrient levels). The Inner Harbour borders on a eutrophic state, and the Outer Harbour is mesotrophic (with moderate nutrient levels). The bottom sediments have a high organic content maintained by inputs from the Don River, the storm and combined sewers, and the Main Sewage Treatment Plant. The planned extension of the STP outfall may improve conditions in the nearshore area, but will affect other parts of the lake ecosystem.

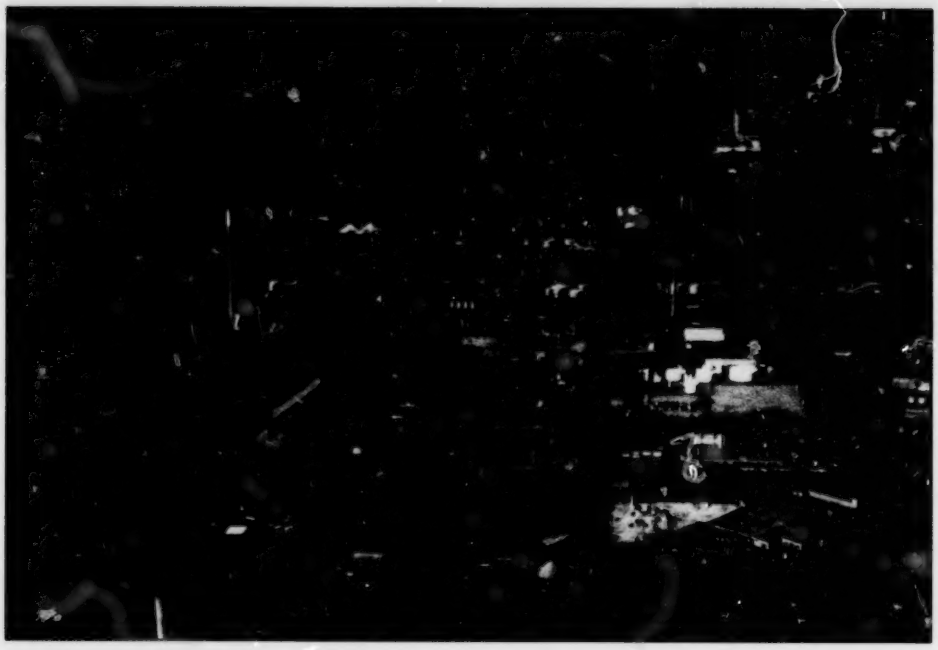
High levels of nutrients in aquatic ecosystems create imbalances in the food web, and can stimulate the growth of aquatic plants such as algae at the expense of other species. This has not yet become a major problem in the study area, probably because of the turbidity of the water (which reduces the penetration of sunlight), wave action, and lack of suitable substrate. The situation bears watching, however: in the summer of 1990, sailors in the Outer Harbour complained about excessive weed growth and sewage in the harbour.

Nutrient circulation in the terrestrial ecosystem varies across the area. The vigour and variety of the vegetation in most semi-natural areas suggests that, in general, essential nutrients are available. However, there are many sites with inhospitable conditions for plant growth — for example, areas of compacted soil and places used for storage of coal, snow-dumping, and metal products recycling. In these cases, plant growth may be limited by the lack of nutrients, or by other factors such as the presence of toxic contaminants, poor soil structure, alkalinity or acidity.

6. Levels of toxic chemicals in the ecosystem

Toxic chemicals have been detected in all components of the subject area's ecosystem — soils, groundwater, surface water, sediments, air, and wildlife. Among the toxic chemicals found were PCBs, dioxins and furans, polycyclic aromatic hydrocarbons (PAHs), phenols, and metals such as cadmium, lead, and mercury. The levels of toxic chemicals frequently exceed guidelines, especially in soils, groundwater, and bottom sediments of the study. Very little is understood about levels of organic chemicals in air and in ambient water.

Sources of toxic chemicals in the East Bayfront/Port Industrial Area include former (and some current) industrial activities, materials used for lakefilling, the sewage treatment plant, and vehicle emissions. Sources outside the study area include the Don River, storm and combined sewer outfalls across the waterfront, upstream sources in the Great Lakes, and regional and long-range transport of air pollutants.



Port Industrial Area, including Ship Channel

Although there are few data on contaminants in wildlife in the area itself, studies have been conducted on benthic invertebrates across the Toronto waterfront; caged clams in the Outer Harbour and Leslie Street Spit; snapping turtles in the Inner Harbour; young-of-the-year spottail shiners from the Leslie Street Spit and Toronto Islands; sportfish from Ashbridge's Bay Park and the Inner and Outer Harbours; and fish-eating birds on the Toronto Islands and Leslie Street Spit. Overall, they show that all trophic levels in the aquatic food web are contaminated with toxic chemicals. Levels of some toxics (particularly persistent organochlorine pesticides) have declined since the mid-1970s, but the rate of decline has slowed down. There is no information on levels of contaminants in plants or animals of the terrestrial food webs.

7. Effects of toxic chemicals on humans and wildlife

Apart from information about fish-eating birds, which have been shown to suffer birth defects, reproductive failures, and population declines, there are few data about the effects of toxic chemicals on wildlife or humans in the study area. The current limitations on recognizing effects and linking them to causes is discussed briefly in the technical paper on *Ecosystem Health.*

Potential pathways that may expose humans in the study area to pollutants are: breathing the air, having contact with surface water through recreation activities, having contact with soils during remediation or redevelopment, eating food grown on allotments, and eating fish caught in the area. Other potential pathways include the occupational use of hazardous materials in the workplace, spills, fires, and explosions.

A number of air pollutants in parts of the East Bayfront/Port Industrial Area at levels

above government standards are known to cause adverse effects on human health. They include ozone (levels are similar to those elsewhere in Metro Toronto), carbon monoxide, suspended particulates, dustfall, and lead. Because there is no information on ambient levels of trace toxins in the air, it is not known whether standards and guidelines related to them are being exceeded.

Fishing at the Hearn circulating channel

Body contact with water containing bacteria and viruses can cause gastrointestinal illness, as well as skin, eye, ear, throat, and nose infections. In the summer of 1990, for the first time since 1987, Cherry Beach was posted to warn people against swimming. There were also more anecdotal complaints about health problems from users of the Outer Harbour than in previous years.

In the East Bayfront/Port Industrial Area, as is typical of any industrial area, many hazardous materials are stored, used, and transported. The audit has shown that several thousand hazardous chemicals are being used, and there are 28 generators of hazardous wastes and 15 PCB storage sites. The health of workers who are exposed to such materials while on the job may be affected. Hazardous materials may also be released into the environment as fugitive emissions to the air, as spills to sewers, or during accidents such as explosions, leaks, and fires. Assessment of the risks of such exposures requires information on quantities, storage procedures, safety measures employed, etc. This type of information is not currently available.

Toxicological studies on laboratory animals have shown that many of the chemicals — such as heavy metals, PCBs, volatile organic compounds, and PAHs — present in the soils and groundwater of the study area can adversely affect their health. It is possible that terrestrial wildlife is affected by contaminants taken up through the food web. Unless preventive measures are taken, people may be exposed to toxic compounds during remediation and redevelopment, as the result of volatilization and resuspension of dust. Because soil remediation is expected to precede redevelopment, hazards to people working or living in the area should be reduced to acceptable levels.

In order to protect human health, and in view of the high levels of mercury, mirex, and PCBs present in the area under study, consumption of some sizes of eight fish species is restricted. A limited study of anglers in the Outer Harbour, carried out in the summer of 1990, showed that most anglers would not eat any fish they caught.

8. Levels of dust, odours, and noise

In parts of the study area, dust, odours, and noise all exceed acceptable levels for residential uses and could affect human health in various ways. Moreover, they are often viewed as tangible symbols of environmental deterioration. Unlike such less-apparent problems as invisible toxic chemicals, they

are evident to people, whether they work in the area, travel through it, live in a nearby neighbourhood, or come to the Outer Harbour for recreation.

9. Variety, quality, and accessibility of opportunities for human activities

The East Bayfront/Port Industrial Area provides industrial employment and recreational opportunities for the City of Toronto. It contributes to the diversity of Toronto's economy, representing 40 per cent of the City's industrially designated land. About 10,000 people are currently employed there, although a number of industries are in the process of leaving the area. In addition, much of the land is vacant or under-utilized, which suggests a future potential to increase employment opportunities and/or diversify land uses.

Recreational activities are concentrated along the north shore of the Outer Harbour, which is an attractive and varied landscape for walking, cycling, observing nature (especially birds and butterflies), swimming, windsurfing, rowing, sailing, and fishing. The Outer Harbour Marina provides a base for power and sail boats.

The north shore of the Outer Harbour is one of the semi-natural areas closest to downtown Toronto, providing opportunities for city dwellers to come in contact with wildlife and the lake without travelling great distances. However, it is difficult to reach the study area by public transit or bicycle or on foot.

10. Safety from environmental hazards

The presence of harmful chemicals, discussed previously, represents a potential hazard to workers through occupational exposure and accidents; to ambulance, fire, and police personnel who respond to incidents; and to the elements of the ecosystem that may become contaminated as a result of spills, leaks or fires. Although there is insufficient information available to assess these risks, in the past two years 73 spills and fires have been recorded involving hazardous materials in the East Bayfront/Port Industrial Area.

Because parts of the East Bayfront/Port Industrial Area are in the floodplain of the Lower Don River, a regional storm of the magnitude of Hurricane Hazel could flood the northern portions of the Port Industrial Area to a depth of one metre (see Figure 10 in Chapter 2). In addition to the risks to human safety and property damage, flooding in the industrial areas could release hazardous chemicals and wastes into the environment.

11. Connectedness with the past

The study area has a rich industrial heritage and is an important part of Toronto's history. The "armature" — docks, Ship Channel, Turning Basin, bridges, railways, and roads — laid out as the 1912 plan was being implemented still forms a strong pattern on the land. Large structures like silos, pylons, chimney stacks, and fuel storage tanks are dominant landmarks evoking past and some present industrial activities. A number of buildings and factories, large and small, have interesting histories and architectural features.

The essential heritage of the original Ashbridge's Bay — a mosaic of wetland habitats teeming with wildlife — has vanished. However, links to it remain: the north shore of the Outer Harbour is still used as a migration stopover for resting and feeding by thousands of birds and butterflies every year, and it provides a habitat for resident wildlife.

The north shore has another historical association for naturalists as the site of important biological research. In the 1950s, Dr. F. A. Urquhart of the University of

Toronto, working at Cherry Beach, undertook the world's first tagging program of monarch butterflies. His research eventually led to the discovery in 1975 of the monarch's main wintering grounds in Mexico.

12. Aesthetics

Beauty being, indeed, in the eye of the beholder, individual perceptions of aesthetic quality are based on a variety of factors: beauty of natural landscapes, architectural form, urban design, landmarks, historical associations, interesting features, and the like.

The East Bayfront/Port Industrial Area evokes a greater range of human reactions than many other places in Toronto: to some, the industrial areas are dirty, smelly, run-down, and unattractive, while they provide others with an exciting mix of powerful images — tall stacks and silos, giant storage tanks and cranes, bascule bridges, and working ships among them. While the empty lots scattered among the industrial buildings appear as scrubby, wasted space to some people, naturalists find them miniature wildlife reserves that are host to vibrant communities of plants and animals.

The character of the area's waterfront ranges from the confined and highly polluted Keating and Ship channels, to the expanse of the Inner Harbour with spectacular views of the Toronto Islands and the City, to the relative wildness of the Outer Harbour.

Those who cherish natural landscapes value the north shore's wild character and variety of landscapes — from open fields to woodlands, and wetland swales to shoreline beaches — and the resultant succession of colours and textures throughout the seasons.

Conclusion

In some respects, the East Bayfront/Port Industrial Area presents two strikingly different images of ecosystem health. The north shore of the Outer Harbour and the Outer Harbour itself are in fairly good health. The north shore, in particular, provides excellent

Coatsworth Cut

habitat diversity and quality for a wide range of plants and animals. The Outer Harbour has fair aquatic habitat diversity, which is reflected in the resident fish community.

The rest of the study area — the industrial areas, and the boat slips and channels — exhibit ecosystem stress, with low habitat diversity and quality, and limited wildlife. Levels of dust, odours, and noise are high and ecosystem health is poor. Even in the industrial areas, however, there are better-quality pockets in the vacant lots dotted throughout.

A number of characteristics of ecosystem stress are apparent across the entire area: air pollution, contamination of soils and groundwater, and toxic chemicals in wildlife. The connections between habitats are poor.

Overall, the assessment makes it clear that some serious problems must be addressed if the healthfulness of the area for wildlife and for human uses is to be improved. The unique features of the area, including its industrial and natural heritage, offer rare opportunities for future regeneration, protection, and enhancement to improve ecosystem integrity. These are discussed in Chapter 5.

CHAPTER FOUR

STEWARDSHIP AND ACCOUNTABILITY

The integrity of an ecosystem depends not only on physical and biological health, but also on the ways humans interact with it. This is clearly expressed in the *Ecosystem Charter for the Great Lakes*, which includes a call to promote all measures and behaviours necessary to achieve and maintain local, basin-wide and global environments free from toxic and other degradations to the health, well-being, and enjoyment of all people and other living things, now and in the future.

In order to achieve these goals, we must have effective institutions, laws, and decision-making processes, operating within an ecosystem approach.

Management activities in ecosystems may be described as stewardship and accountability. "Stewardship" implies care of the whole ecosystem (physical and living, including humans). Public bodies — governments and other institutions — are entrusted with the responsibility of managing human activities and their effects on ecosystems. Non-governmental organizations also play an important role as watchdogs, educators, researchers, and advocates. The activities of landowners and tenants are influenced by a variety of laws and regulations intended to protect the environment, and human health and safety.

"Accountability" requires that public administration be structured in a way that enables the public to know who is responsible for any given matter. There should be a clear process for governments and other institutions to report on their decisions, plans, and budgets, as well as the results of their actions. Doing so provides opportunities for the public and their elected officials to comment on and influence the activities of public bodies.

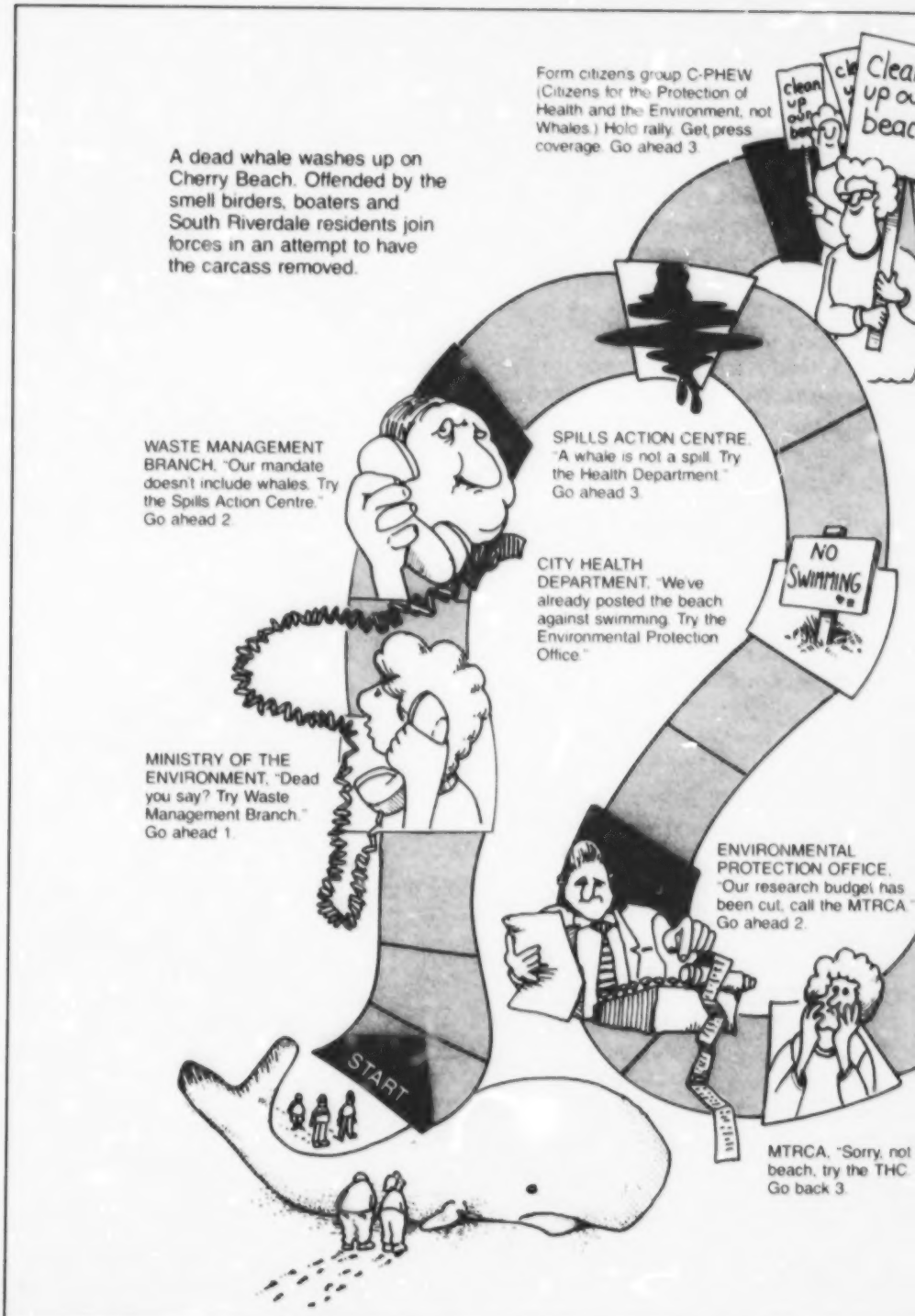
Early in the work of the Royal Commission, an examination of stewardship and accountability on the Toronto waterfront showed that "there is currently no overall ecosystem approach to the planning, development, and management of the waterfront" (report of the Environment and Health Work Group, 1989). This has been substantiated by the findings of the environmental audit of the East Bayfront/Port Industrial Area. During the research and analysis undertaken by the audit work groups, many specific issues arose, among them:

- the jurisdictional frameworks that have been set up at different levels of government, within which roles and responsibilities are assigned;
- the laws, regulations, and policies designed to manage human activities;
- environmental monitoring and research programs that analyse the effects of human actions on the environment;
- strategies for planning, assessing, and remediating in order to prevent environmental problems from occurring and to clean up existing problems;
- the public's role in establishing values and in protecting the environment.

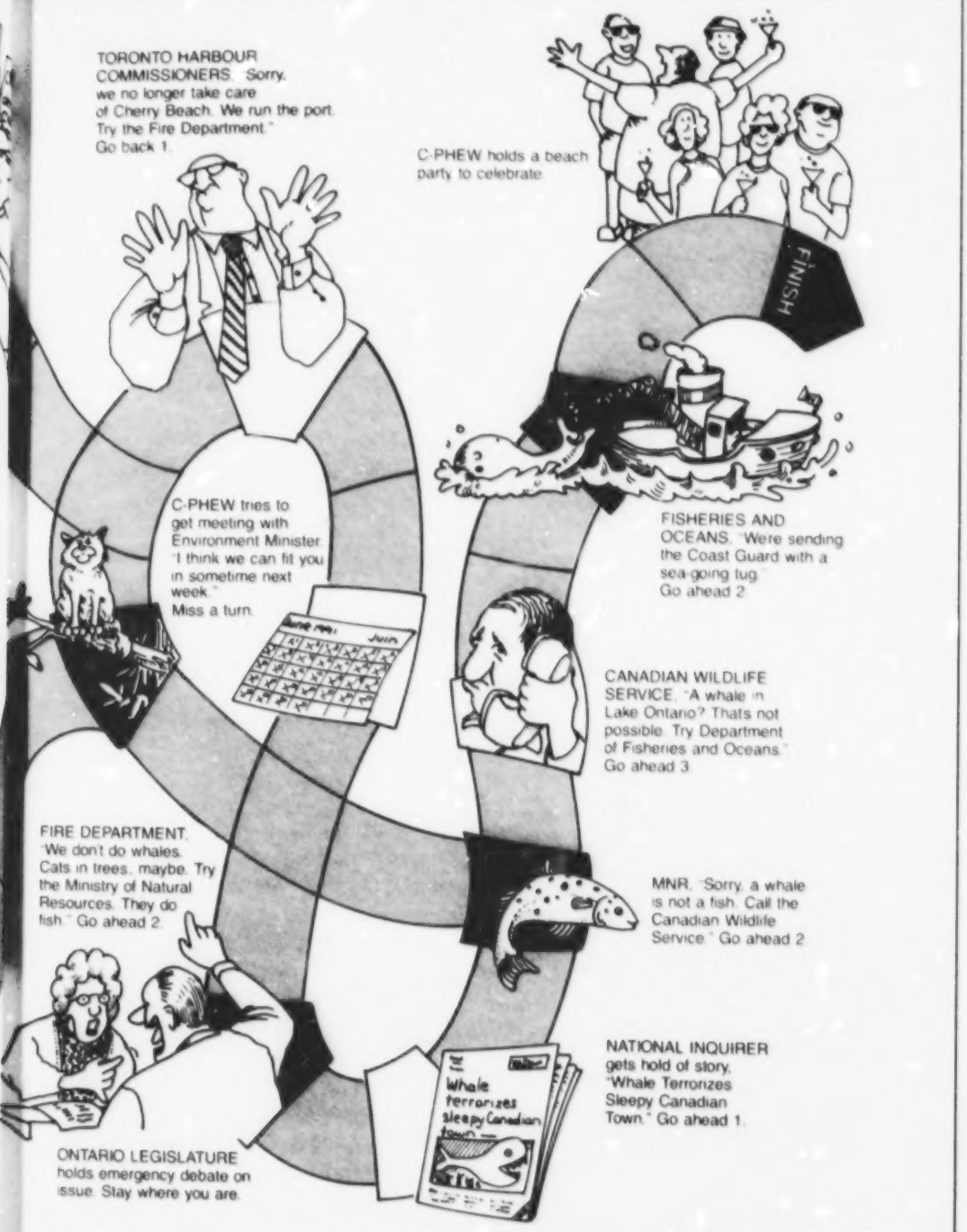
This chapter explores these aspects of stewardship and accountability, which have become evident during the environmental audit. It is intended to show how administrative obstacles frustrate attempts at achieving greater ecosystem integrity, and to use that understanding as a starting point for developing approaches to overcome such limitations. This is a preliminary examination: these and other issues will be considered further in the Royal Commission's ongoing work.

Who's in Charge? — The Jurisdictional Framework

In Phase I of the environmental audit, a preliminary review was undertaken of the jurisdictional framework governing the environment in the study area. A summary was published as Chapter 5 of *Environment in Transition*, the audit report. The review examined the laws, policies, and guidelines


A dead whale washes up on Cherry Beach. Offended by the smell birders, boaters and South Riverdale residents join forces in an attempt to have the carcass removed.
Form citizens group C-PHEW (Citizens for the Protection of Health and the Environment, not Whales.) Hold rally. Get press coverage. Go ahead 3.
SPILLS ACTION CENTRE. "A whale is not a spill. Try the Health Department." Go ahead 3.
CITY HEALTH DEPARTMENT. "We've already posted the beach against swimming. Try the Environmental Protection Office."
ENVIRONMENTAL PROTECTION OFFICE. "Our research budget has been cut, call the MTRCA." Go ahead 2.
MTRCA. "Sorry, not beach, try the THC." Go back 3.
MINISTRY OF THE ENVIRONMENT. "Dead you say? Try Waste Management Branch." Go ahead 1.
WASTE MANAGEMENT BRANCH. "Our mandate doesn't include whales. Try the Spills Action Centre." Go ahead 2.
START
NO SWIMMING

Who's in charge?


TORONTO HARBOUR COMMISSIONERS. "Sorry, we no longer take care of Cherry Beach. We run the port. Try the Fire Department." Go back 1.
C-PHEW holds a beach party to celebrate.
FINISH
C-PHEW tries to get meeting with Environment Minister. "I think we can fit you in sometime next week." Miss a turn.
FISHERIES AND OCEANS. "Were sending the Coast Guard with a sea-going tug." Go ahead 2.
CANADIAN WILDLIFE SERVICE. "A whale in Lake Ontario? Thats not possible. Try Department of Fisheries and Oceans." Go ahead 3.
FIRE DEPARTMENT. "We don't do whales. Cats in trees, maybe. Try the Ministry of Natural Resources. They do fish." Go ahead 2.
MNR. "Sorry, a whale is not a fish. Call the Canadian Wildlife Service." Go ahead 2.
NATIONAL INQUIRER gets hold of story. "Whale Terrorizes Sleepy Canadian Town." Go ahead 1.
Whale terrorizes sleepy Canadian town
ONTARIO LEGISLATURE holds emergency debate on issue. Stay where you are.

that deal with the quality of air, surface waters and groundwater, site decommissioning and clean-up, and natural and built heritage. The review concluded that:

> The existing regulatory framework is characterized by overlap and duplication by different levels of government, by joint action on some issues, and by failure to exercise authority that is already in place....The framework is fragmented, with different instruments governing separate aspects of the environment — which makes it difficult to apply ecosystem goals and principles.

For an example of the complexity of the jurisdictional framework in the study area, one need look no further than surface waters. The federal government (through the departments of Environment, Public Works, Transport, and Fisheries and Oceans) has jurisdiction over navigation, shipping, harbour activities, fisheries, transboundary waters and, to a limited extent, water quality. The federal Board of Toronto Harbour Commissioners is a major landholder in the area and is responsible for managing the harbour and port.

Provincially, the Ministry of the Environment has the primary responsibility for protecting water resources, while the Ministry of Natural Resources owns waterlots and is responsible for protecting wetlands and fisheries, and the Ministry of Municipal Affairs oversees municipal planning.

The Metropolitan Toronto and Region Conservation Authority (MTRCA) has a mandate to reduce erosion and flood risks from the Don River and implements a Ministry of the Environment program designed to control the quality of fill used in lakefilling projects in Metro. The Municipality of Metropolitan Toronto manages the water supply and sewage systems and operates the Main Sewage Treatment Plant, while the municipalities of Toronto, Scarborough, East York, and North York own and maintain the sanitary and storm sewers that flow into the Main Sewage Treatment Plant, the Don River, and the nearshore of Lake Ontario.

Through a maze of laws, policies, and guidelines, those agencies regulate the use of surface waters in the study area: the use of the harbour and Lake Ontario for shipping and navigation, for industrial cooling and process needs, as wildlife habitat, for drinking water, for recreational activities, and for receiving stormwater and treated sewage.

Some uses can be at cross-purposes with others. For example, the use of Lake Ontario as a receiving body for stormwater and combined sewer overflows conflicts with the use of the Inner Harbour and Ashbridge's Bay by windsurfers and sailors. The dredging required to keep harbour channels open for navigation and to reduce flooding, and the lakefilling used to create aquatic parks, often impair local water quality. While the aquatic parks themselves can provide protected fish habitat, they also alter coastal processes and currents. Building "hard-edged" channels in rivers to stop erosion, and creating docks and seawalls for shipping and boating, eliminate fish habitat through the loss of shallows at the vital water/land interface.

Examined this way, it becomes clear that there are currently no means to take a comprehensive, ecosystem view of the entire aquatic system in the study area. When other aspects of the natural environment are included — air, groundwater, land, and living organisms, including humans — the situation becomes even more complex. While a plethora of agencies focus on different aspects of the natural environment, no one cares for the ecosystem as a whole. Former Federal Auditor General Kenneth Dye recently remarked on this fragmentation of jurisdictions in environmental protection while presenting his final audit of the federal government:

> There's nobody minding the store. You've got 24 departments and agencies handling 50 laws ... who can be held responsible for some serious breakdown in the environment? Who's in charge is the question I'm asking because I think someone should be in charge.

While the Auditor General's comments were aimed at only the federal government, the answer to who's minding the store becomes even more obscure in the Port Industrial Area, where four levels of government are involved.

The fragmentation of jurisdictions dealing with environmental protection can be addressed through communication and inter-agency co-operation. Once again, the aquatic environment provides an example: provincial guidelines are inadequate in dealing with the sediments, extensively contaminated with organic chemicals and heavy metals, that are present in the study area and in other harbours and rivers in the Great Lakes Basin. The Ontario Ministry of the Environment (MOE) is developing more comprehensive Sediment Quality Guidelines for the remediation of contaminated sediments. At the same time, Environment Canada is developing its own federal guidelines for contaminated sediments, and is working closely with the Ontario Ministry to ensure that their respective sets of guidelines are complementary, and not in conflict.

Nonetheless, it seems that, all too often, agencies work in isolation on issues, have too narrow a focus, or operate without full participation by all the stakeholders needed to implement the plans they make. The Metro Toronto Remedial Action Plan (RAP) is being developed by Environment Canada and the Ontario Ministry of the Environment to restore the aquatic environment of the Toronto waterfront. But many of the agencies that must be part of the process — the municipalities located at the headwaters of the Don, Humber, and Rouge rivers, for example — are not represented on the RAP Team and have only limited participation on its Technical Advisory Committee. Indeed, very few decision-makers are involved in the RAP, with municipal politicians being assigned a token role on the Public Advisory Committee. All this begs the question: how can plans be implemented effectively?

Sometimes, the public desire for action on environmental issues is not fulfilled because of gaps in jurisdiction, inadequate legal tools or insufficient resources. In some cases, this has led to an agency without a specific mandate moving in to fill a perceived void. For example, the MOE has given the Metropolitan Toronto and Region Conservation Authority (MTRCA) responsibility for monitoring the quality of fill used in lakefilling. While no resources or funding were available provincially to operate such a program, according to the *Conservation Authorities Act* the MTRCA can operate it on behalf of the MOE and charge for "services". Although the MOE remains responsible for approval, auditing, and enforcement of the program, there is concern about a possible conflict of interest when the MTRCA — one of the most active bodies undertaking and planning lakefilling along the Toronto waterfront — is responsible for monitoring lakefill quality.

The Task Force to Bring Back the Don is a local City of Toronto body formed in response to the apparent inaction of higher levels of government in cleaning up the Don River. Although the task force has an admirable vision of rehabilitation of the river and its watershed, it cannot achieve much unless there is action by the various watershed jurisdictions. The direct mandate of the task force is related to only four of the 38 kilometres of the river's length, those in its lower reaches. However, the *first* meeting of river-dwellers and stewards from all parts of the Don watershed was held on 28 November 1990. At the gathering, which was hosted by the Royal Commission, participants shared information about existing

government programs and about a variety of local initiatives being undertaken in different parts of the Don watershed. They showed that there is considerable grass-roots determination and enthusiasm, and called for leadership to help develop a co-ordinated approach to watershed regeneration.

The existing jurisdictional framework for protecting the environment has evolved over time, and, in the main, was developed before the need for an ecosystem approach became evident. Government departments responsible for environmental protection are separated from those with mandates to manage natural resources, energy, communications, transportation, housing, municipal affairs, etc. Clearly, the time is ripe to re-evaluate the roles and responsibilities of these agencies — both those explicitly charged with environmental stewardship (such as Environment Canada, the Ontario Ministry of the Environment, and the City of Toronto's Environmental Protection Office) and those not traditionally responsible for environmental matters.

The City of Toronto is moving in this direction. The Environmental Protection Office (EPO) was established as part of the Department of Public Health in 1987. It is now the only office of its kind in a Canadian municipality, although several others (Hamilton-Wentworth, Ottawa, and Vancouver) are in the process of establishing environmental protection offices or programs. The EPO reports to City Council through the Medical Officer of Health. It conducts research, mostly of a secondary nature, on assessing exposure pathways of potentially toxic substances. A major study of alternative sources and treatments of drinking water in the City of Toronto was published in 1990. The Planning and Development Department refers City planning projects and selected development proposals to the EPO for environmental review. Since its inception, the EPO has reviewed approximately 100 applications on a variety of sites, including land formerly used for industrial or automobile related uses, land known to be contaminated, projects involving lakefilling, and all sites where it has been proposed that zoning be changed from industrial to residential.

The City took two further steps this year to integrate environmental considerations in various areas of its responsibility. First, a Subcommittee of Heads on the Environment — chaired by the Medical Officer of Health and composed of the commissioners of Works, and Planning and Development, and the City solicitor — was set up to address environmental issues and policies. Second, the mandate of the Department of Public Works was recently expanded to include the environment, with a new Deputy Commissioner to oversee this aspect of its work.

Clearly, we are seeing more attempts to overcome the barriers created by jurisdictional fragmentation, in order to move towards greater ecosystem integrity. They do not require creation of new "super-agencies", but depend on more effective co-ordination and joint programs by existing bodies.

Further support for co-operation comes from the concept of Waterfront Partnership Agreements proposed by the Royal Commission in its *Watershed* report, and based on the premise that all the partners should be at the table when plans are being made for the waterfront. Their different contributions should be developed concurrently, with ample opportunities for exchange of ideas, feedback, and necessary modifications. The partners should agree to a specific timeframe in which to work, to reduce uncertainty and ensure that the work gets done. In some cases, it may be necessary for the group to appoint a neutral chair, to operate at arm's length from the key stakeholders and guarantee the objectivity of the process. This "round table" approach allows for more flexibility, co-operative involvement, and timely decision-making than the linear, fragmented systems currently in place.

The round-table concept described here should not be confused with the round tables

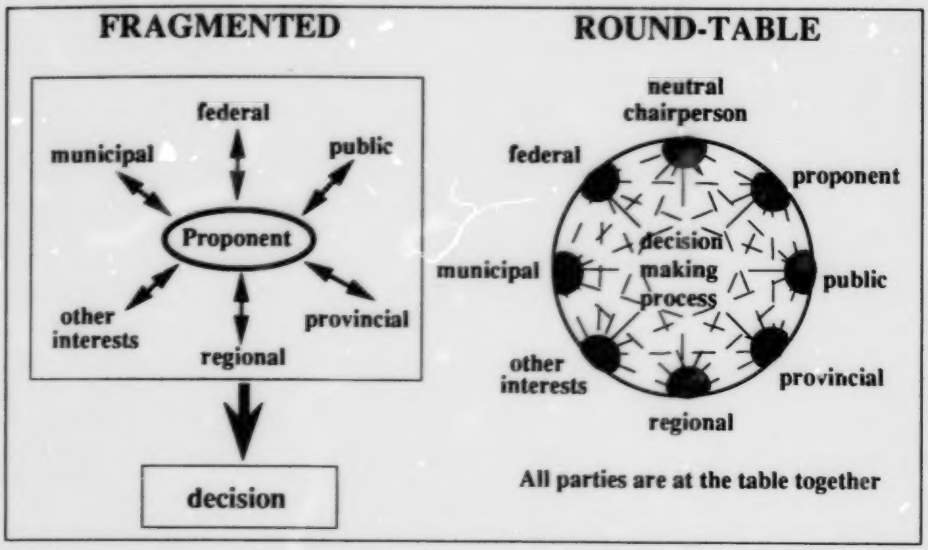


Figure 20 Contrasting decision-making processes

established to address environmental and economic issues (e.g., the National Round Table, the Ontario Round Table on Environment and Economy), which, in general, are designed to bring together representatives of all sectors of society to promote sustainable development. Their key roles are to facilitate dialogue, provide guidance on sustainable development strategies, and encourage appropriate policies, programs, and projects.

The Rules of the Game — Legislation, Regulations and Enforcement

Historically, attempts to protect humans, wildlife, vegetation, and built structures from pollutants have focussed on limiting concentrations of contaminants that may be present in a medium or product, or that may be discharged into media such as air or water. "Acceptable" levels of contaminants are usually set for the most sensitive receptor — the receptor most vulnerable to the contaminant. In the case of ambient air, for example, that could be humans, vegetation or even buildings. However, regulating by limiting concentration presents several problems.

First, limiting concentrations of a particular contaminant emitted into a medium assumes that "dilution is the solution", and that the biosphere has an unlimited ability to absorb the pollutants put in it. Such an approach has led to allowances for "zones of non-compliance" — areas in which water quality does not have to meet Provincial Water Quality Objectives. That kind of non-compliance zone exists around the outfall of the Main Sewage Treatment Plant. The growing understanding of the problems associated with toxic substances that persist in the environment and can bioaccumulate in tissues have shown that this dilution approach is no longer adequate to protect the environment and human health from such substances. Nor can this approach protect against pollutants, like sulphur dioxide, which are emitted as one substance but cause problems downwind as another (acid rain).

Future provincial regulations enacted under Ontario's Clean Air Program and the Municipal-Industrial Strategy for Abatement (MISA), which deals with industrial

and municipal dischargers, are intended to address these shortcomings. Both programs will control not only the allowable concentration of contaminants, but also the total quantity that can be emitted into the environment. Today, however, all regulation is done by limiting concentrations, for example in effluents from the Main Sewage Treatment Plant or from smokestacks of industries in the study area.

A second problem with regulating concentrations of contaminants is that "allowable" or safe levels for a particular compound are usually calculated for a single medium such as air or water. Risk assessments traditionally have not considered total exposure — the cumulative effects of exposure to a particular compound in a variety of media. Taking a total exposure approach involves setting acceptable limits by taking into account all possible pathways of exposure — air, food, drinking water, etc. — and ensuring that exposure from all sources does not exceed the acceptable daily intake for a contaminant.

In 1990, the Ontario Ministry of the Environment set up a committee, the Advisory Committee on Environmental Standards (ACES), to provide advice on multi-media standards to protect the environment and human health. ACES will receive and review the Ministry of the Environment's recommendations on limits, solicit public input, and make recommendations to the Minister.

A third problem with the current approach to regulation-setting is its inability to deal with more than one chemical at a time. Defining an "acceptable" exposure level usually involves testing a single chemical on lab animals in controlled experiments, and then extrapolating to human systems. But in the real world, animals and humans are exposed to a "chemical soup" in the air they breathe, the water they drink, and the food they eat. Current limit-setting cannot deal with the possibility of additive, antagonistic or synergistic effects of exposure to a multitude of chemicals.

The limitations of current methods for standard-setting are compounded by the sheer numbers of contaminants in the environment. Estimates of the numbers of chemical substances in use in Canada vary widely: the Ontario Federation of Labour estimates that more than 500,000 toxic substances are used in industry, an Ontario Ministry of the Environment paper on *Working Together for a Better Environment* says there are up to 70,000 industrial chemicals in use in Ontario, and 20,000 hazardous chemicals are cited in *Canada's Green Plan*. Very few of these chemicals have been subjected to rigorous testing for potential acute or chronic effects. This is of immediate concern to those in the "front lines" — the workers who handle such products in the workplace; the ambulance, fire, and police personnel who respond to emergencies; and the crews involved in cleaning up spills and other accidents.

The assessment and regulation of hazardous chemicals is a slow, expensive, and painstaking process. Under Canada's *Environmental Protection Act*, a Priority Substances List of 44 potentially hazardous substances has been developed. *Canada's Green Plan* indicates that assessment of these substances will be completed by 1994, and appropriate regulations will be established for them. The long-term goal is to assess a total of 100 priority substances by the year 2000. The Government of Canada is also participating in an international program for evaluating toxic chemicals.

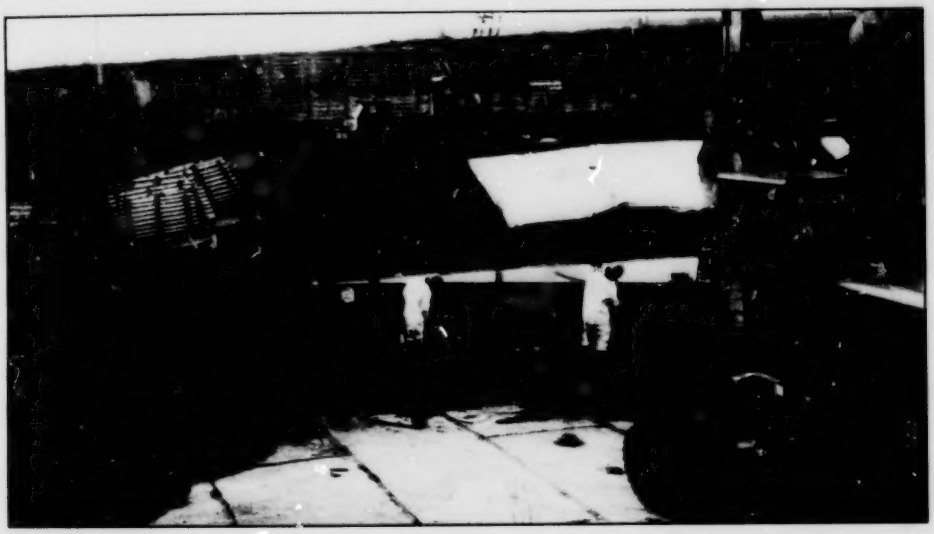
There are regulations governing the transportation of hazardous materials, the movements of hazardous waste, and worker safety: they involve different numbers and types of chemicals. For example, the federal *Transportation of Dangerous Goods Act* lists some 3,500 hazardous products; Regulation 309 of *Ontario's Environmental Protection Act (EPA)* covers nearly 500 hazardous wastes in several schedules; and about 600 compounds are regulated under the provincial *Occupational Health and Safety Act*.

Similarly, there are regulations for different purposes that cover limited numbers of contaminants in the environment itself. For example, the provincial *Open Water Disposal Guidelines* for soils or other fill materials include 20 parameters, only one of which (PCBs) is organic. Ontario's objectives for drinking water cover approximately 100 substances, whereas provincial ambient water quality objectives and guidelines exist for 87 chemical compounds. Regulation 308 of the *Ontario Environmental Protection Act*, which governs air emissions, includes limits for 100 chemicals.

of most of them in ambient water, drinking water, sediments, soils or animal tissues.

The provincial *Guidelines for the Decommissioning and Clean-up of Sites in Ontario* cover only 18 chemicals and heavy metals that may contaminate soils. Although interim soil guidelines have been set for dioxins, furans, and PCBs, no criteria exist for other organic compounds, including common solvents such as benzene, toluene and xylene, and PAHs, all of which have been found in the soils of the study area.

The relationship between proposed land uses and soil quality guidelines is not clear.



Removal of soils from a coal tar contaminated site in Ottawa

It is interesting to compare the numbers of regulated compounds to the provincial Effluent Monitoring Priority Pollutants List compiled under the Municipal-Industrial Strategy for Abatement (MISA) program. The list includes 266 chemicals potentially discharged by industries that are considered to be of concern because of their persistence in the environment, potential to bioaccumulate, and/or harmful effects on wildlife. This means that there are 266 compounds for which discharge limits may be set under MISA although there are still no standards, objectives or guidelines for acceptable levels

MOE's guidelines specify more stringent clean-up requirements for agricultural, residential, and parkland uses than for commercial and industrial purposes. In general, guidelines for the latter are less stringent (one to eight times the level, depending on the specific substance). However, because there is no published rationale for the way the guidelines have been set, it is difficult to understand the basis for these differences.

Because the provincial *Guidelines for the Decommissioning and Clean-up of Sites* do not include all the contaminants found in the soils and groundwater of the East

Bayfront/Port Industrial Area, the onus will be on proponents to develop appropriate and comprehensive clean-up levels for approval by the Ministry of the Environment. The guidelines provide two options: landowners may propose guidelines developed elsewhere as suitable for their site, or they may develop site-specific guidelines. The latter approach has recently been used for two former petroleum refinery sites west of Toronto (Shell in Oakville and Texaco in Port Credit).

The City of Toronto, which is developing a soil and groundwater remediation strategy for the Ataratiri development site, has to consider a number of contaminants not covered by the Shell/Texaco guidelines. Several sites throughout the City are currently being studied to determine background levels of parameters, as a further guide to developing suitable clean-up levels. Given the proximity of the Ataratiri site to the East Bayfront/Port Industrial Area, and the similarities in soil conditions, it would be beneficial for the parties involved in both areas to collaborate on this difficult and time-consuming process.

Phase I of the environmental audit noted that "many aspects of environmental protection depend on guidelines and policies rather than enforceable standards". Standards are usually embodied as regulations under an act, and are legally enforceable. Although guidelines are expressed in similar language, they are usually only recommendations, and not legally enforceable except as incorporated into legal instruments such as Certificates of Approval or Control Orders. The MOE's discussion paper on the *Establishment of the Advisory Committee on Environmental Standards* (ACES) noted that:

> Standards are preferable because of their legal enforceability, but they require a more comprehensive database of toxicological and environmental fate information. Environmental fate information describes a chemical's behaviour in the environment by assessing characteristics such as its persistence, its ability to bioaccumulate and its tendency to move from one environmental compartment to another. Where this information is less complete, guidelines or interim standards are set.

During the audit, this lack of standards was noted as a particular problem in decommissioning industrial sites. The MOE's *Guidelines on the Decommissioning and Clean-up of Sites in Ontario* are intended for use when remediation is planned for a site at which levels of contaminants in soil exceed certain criteria; but, as guidelines, these are not legally enforceable.

It is clear to the audit team that improving standards will require more co-ordination and monitoring, as well as more time, effort, and money invested in fundamental research. Without basic information about the environmental fate of compounds — knowing how chemicals behave in the ecosystem — regulatory bodies have inadequate information on which to set standards, and will continue, instead, merely to set guidelines.

The *Decommissioning and Clean-up Guidelines* are applied only when the MOE is asked to review a proposal (such as an official plan amendment or subdivision plan) that involves a change in land use. If redevelopment is proposed but land use will remain the same, the guidelines do not apply. The MOE may also act under the *Ontario Environmental Protection Act* if it is suspected that redevelopment will have an impact on the environment off-site. Therefore, in general, development and building permit applications not reviewed by the MOE escape the scrutiny they would get if the guidelines applied.

A recent example in the Port Industrial Area illustrates the point. In 1990, the Toronto Harbour Commissioners submitted a building permit application to the City of

Toronto to build a structure (a crane-like sculpture) in a proposed park on the south side of the Keating Channel. The industrial zoning in this area allows recreation facilities and parks, and all requirements for the building permit were met. However, as part of the review process under the Declaration of Provincial Interest in the East Bayfront/Port Industrial Area, the City's Commissioner of Building and Inspections brought the park proposal to the attention of the provincial government, through the office of the Premier's Special Advisor on Waterfront Development. The MOE examined a report on soil conditions at the site and concluded that remediation should be undertaken because levels of copper, lead, mercury, and zinc exceeded guidelines for parkland use. This is a situation in which, if there had been no Declaration of Provincial Interest, a proposal to develop a park on a contaminated site might have been approved without any consideration of significant environmental conditions.

During the *Hazardous Materials* study of the environmental audit, questions were raised about decommissioning equipment, storage tanks, and pipelines when industrial operations change or close down. The *Guidelines on Decommissioning and Clean-up of Sites in Ontario* require that, at facilities to be decommissioned, a preliminary inventory of potential contaminants and contaminant sites be drawn up. This includes plotting the locations of above-ground and underground storage tanks and pipelines. However, there is no requirement to empty or remove tanks and pipelines (which may be leaking into the soil or could be ruptured during redevelopment).

But even the most powerful regulation is useless unless it is enforced. Unfortunately, it is generally true that enforcement branches of government are understaffed and overworked. In Metro, for example, there are 19 health and safety inspectors with the Ontario Ministry of Labour who are responsible for monitoring an estimated 25,000 industrial establishments in Metro Toronto. One inspector is responsible for the area stretching from Yonge Street to Coxwell Avenue, and as far north as Dundas

Abandoned industrial site

Street, which includes the East Bayfront/ Port Industrial Area.

The Ontario MOE's Central Region is responsible for enforcing provincial environmental regulations. There are only nine enforcement officers for all of Metro Toronto, and the person responsible for the East Bayfront/Port Industrial Area also covers the region stretching from Yonge Street on the west to parts of Scarborough.

Another major enforcement issue is how causes of pollution are pinpointed. For example, when a complaint is made about an odour emanating from a particular source in the Port Industrial Area, an inspector from the MOE visits to confirm the source. If the complaint is made after working hours, if weather conditions change, or if the problem is corrected at source, it is impossible to trace the problem to its point of origin. Such a complaint becomes "unattributable" to any cause. Similarly, there are difficulties when municipalities try to locate residences where illegal hook-ups of toilets have been made to the storm sewer system; the tracking process is long and drawn out, and often unsuccessful.

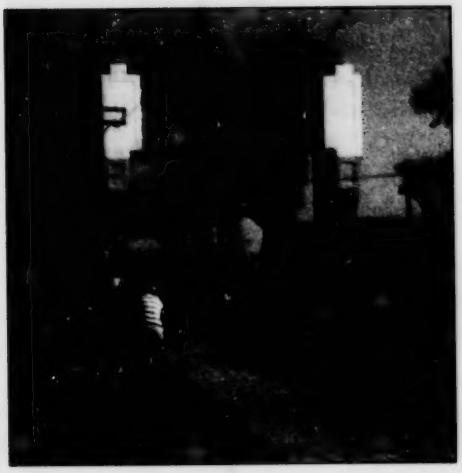
From the perspective of developers, industries, and others involved in economic activities, the regulations and processes that protect workers and the environment are often seen as a burden. Some of the industries in and near the East Bayfront/Port Industrial Area have taken a proactive approach to this issue. They recognize that they are coming under growing government and public scrutiny. The regulatory framework is complex and changing, and there are increasing consequences of non-compliance. This has led many of the larger companies (e.g. Redpath Sugars, Lever Brothers, Colgate Palmolive) to undertake comprehensive analyses of their operations and the regulations or programs that apply at each stage. Armed with this information, changes have been made to reduce wastes, limit noise, control odours and other emissions, use less hazardous chemicals, etc.

There is currently little regulatory protection in place for natural habitats in the study area, although there are several municipal initiatives under way. As mentioned in the Phase I report, the federal *Fisheries Act* can be a very powerful tool to protect fish habitat, but its potential is rarely used. The *Ontario Planning Act* enables municipalities to protect natural heritage through zoning and designation of significant areas such as valleyland impact zones, environmental resource areas, etc. The City of Toronto's *Central Waterfront Plan* includes proposals for new zoning to protect natural features along the north shore of the Outer Harbour, the Outer Harbour Marina, and the Outer Harbour itself. The Metro Toronto official plan now under revision is expected to designate zones for environmental protection.

Under the *Ontario Heritage Act*, municipalities may protect their past by designating properties of historical or architectural significance. The *Planning Act* allows them to establish zoning restrictions to limit development and uses, and to establish design guidelines.

In practice, attempts to preserve the built heritage have traditionally focussed on protecting sites and buildings deemed to have outstanding heritage significance, architectural qualities, and the like. Using these criteria, the only building in the East Bayfront/Port Industrial Area designated by the Toronto Historical Board is the Bank of Montreal at the corner of Cherry and Commissioners streets. The *Ontario Heritage Act* is currently being reviewed in order to strengthen and broaden its ability to help preserve heritage; this might meet the growing interest in protecting Ontario's industrial heritage — which could mean that, even as change occurs to meet future needs, a sense of the past is retained. (This is discussed further in Chapter 5.)

Bank of Montreal



Cherry Street bascule bridge

Baselines — Environmental Monitoring and Research

Knowledge of the environmental conditions in an area is an important prerequisite for effectively protecting the environment. It is necessary, first, in order to understand the possible severity of problems and, second, in order to identify the sources of pollution. Moreover, thorough understanding of the problems is crucial in developing effective remedial programs, and in establishing a baseline against which future progress may be measured.

As a result of the environmental audit, there is a good deal of information to guide efforts at healing and regenerating ecosystem integrity (see the next chapter). On the other hand, it has also helped pinpoint significant gaps in our understanding of the environmental conditions in the study area. For example, in dealing with air quality, we have a good understanding of the emissions of conventional pollutants from major industries in and near the area. However, knowledge of levels of organic chemicals in the air is poor, as is the understanding of the relative inputs of these pollutants from area sources (industries, the Main Sewage Treatment Plant, fugitive emissions from tank farms, etc.). Our understanding of the Gardiner/Lakeshore Corridor's impact on the environment — and it is the most significant source of air pollution in the area — is poorer still. All that can be said is that levels of carbon monoxide, dust, particulate, and lead are thought to be high in the vicinity of this traffic corridor, but they have never been measured.

Accurate knowledge of the level of pollutants in the air makes environmental planning and regulation easier. However, preliminary modelling for the East Bayfront/Port Industrial Area, undertaken during Phase II of the environmental audit, was restricted by lack of data on fugitive emissions, source emissions, upper air characteristics, and wind speed and direction.

The environmental audit has added to the growing database of information on soil: its sampling program provided a better idea of the range of contamination and the types of problems in the area's soils and groundwater. A great variation in soil contamination was evident from site to site, and even across a single site. Because migration of contaminants in groundwater flowing through the area can affect adjacent sites, any plans to redevelop the East Bayfront/Port Industrial Area should include detailed studies of adja-

cent soils and groundwater before site-specific remediation plans are developed.

The work carried out by the environmental audit's natural heritage work group revealed a wealth of information about existing habitats, and the types of mammals, reptiles and amphibians, fish, birds, and butterflies that live in or migrate through the study area. Questions remain, however, about the amounts of habitat needed by wildlife, the health of wildlife communities, and the health of individual animals in the study area, especially with regard to levels of contaminants. Occasional monitoring of sportfish is carried out by the Ontario Ministry of the Environment, and the Metropolitan Toronto and Region Conservation Authority has done some biomonitoring using clams in the Outer Harbour.

The Canadian Wildlife Service investigates contamination in Great Lakes birds, including those on the Toronto Islands and Leslie Street Spit. However, there is little or no monitoring of contaminant levels in plants or animals of the terrestrial food web, anywhere in the Great Lakes Basin. In short, there is little information to assess whether the air, soil or water in the study area affect the health of wildlife, and if so, to what extent.

The aquatic environment in the study area is the least well understood. In Phase I of the audit, we noted that:

> A number of water quality studies have been undertaken along the Toronto waterfront. Most of them had specific objectives — studying the effects of dredging, for example. Accordingly the contaminants being analysed, the sampling methods being used, and the sites at which sampling was carried out have varied from study to study.

The environmental audit's work group on water noted that the lack of long-term monitoring makes it difficult, if not impossible, to comment on trends in water quality. Our knowledge of the conditions of the aquatic environment is inadequate, in part because there is no co-ordinated monitoring, but also because it is a difficult system to understand. The aquatic environment is dynamic, with dramatic seasonal (and sometimes daily) changes in temperature and currents. Some inputs of pollutants are fairly consistent (the effluent from the Main Sewage Treatment Plant outfall, for example), while others — the Don River, storm and combined sewers — vary dramatically during rain storms. Circulation patterns and residence times of water in the Inner and Outer harbours are poorly understood.

Although it is known that bottom sediments throughout the study area are contaminated with organic chemicals and heavy metals, "hot spots" are not mapped. The effect of contaminated sediments on ambient water quality is virtually unknown, as is the effect of contaminated sediments on aquatic biota.

Historically, environmental monitoring has been used to attempt to ascertain what levels of contaminants are present in various components of the environment — air, surface or ground waters, and, less frequently, human or animal tissues — as if these components are separate from each other. Monitoring in the Toronto region has rarely been used to examine the movement of contaminants through pathways in an ecosystem. In the study area, some questions still need to be addressed:

- How are contaminants in bottom sediments affecting ambient water quality and aquatic biota?
- How is the contaminated soil in the Port area affecting groundwater quality, and how is the groundwater affecting the Inner and Outer harbours?
- Are contaminants in the soils, groundwater, surface waters, and air being taken up by plants and animals in the terrestrial food web? If so, are there adverse effects on wildlife?

Herring gull

- Where do contaminants discharged from, say, a combined sewer end up in the aquatic environment? Are they in sediments in a localized area? Do they remain adsorbed to the sediments, or are they dissolved and released into the surrounding water? Do the sediments move? Does evaporation send contaminants from surface water into the air?
- Do the emissions into the air from sources in the study area cause problems — such as high concentrations of ground-level ozone — elsewhere? How much deposition of air pollutants occurs on land or water in the study area?
- Are the hazardous materials being used, stored, and transported through the study area affecting ambient environmental conditions?

The Metropolitan Toronto and Region Conservation Authority (MTRCA) has been attempting to answer some of these questions through its ongoing program of monitoring the disposal of dredgeates from the Keating Channel. The MTRCA is attempting to ascertain if contaminants are migrating from the confined dredgeate disposal cells on the Leslie Street Spit. The program includes sediment analysis, an examination of benthic invertebrate communities, and biomonitoring using caged clams. Although these studies suggest that migration of contaminants from the disposal cells is minimal, there are simply not enough baseline data on sediment and water quality in the Outer Harbour to be able to understand fully what is happening in the ecosystem.

The lack of baseline information on the aquatic environment in the area is disturbing, especially given the efforts being expended to develop the Metro Toronto Remedial Action Plan (RAP). The RAP is intended to be a comprehensive plan for restoring the aquatic environment of the Metro Toronto waterfront. Options for remediation have been outlined and are being discussed. Without adequate baseline information, there will be uncertainty in the process for selecting "preferred" remedial options. And without an ongoing, comprehensive, co-ordinated, waterfront-wide monitoring program, it will be impossible to measure the effects of remedial options once they have been implemented.

Several recent proposals have addressed the need for better access to ecological information to assist management and decision-making. For example, *Canada's Green Plan* includes a commitment to "establish a Great Lakes Pollution Prevention Centre by 1992 to act as a focal point for research and information activities. The Centre, a catalyst for action on pollution prevention and an information clearing-house, will be linked directly to other research centres such as the Canada Centre for Inland Waters, McMaster University and the St. Lawrence Centre".

A Bioregional Information Network for Great Lakes Ecosystems (BINGLE) has been proposed by Ron Shimizu and Henry Regier of the University of Toronto, and George Francis of the University of Waterloo. They suggest that it could begin with three pilot projects in southern Ontario: the Metro Toronto and Hamilton Harbour RAPs, and a proposed Long Point Heritage Area Security Plan.

In addition, discussions are currently under way among the federal and provincial

governments, several universities, and the Royal Commission about the possibility of establishing a multi-disciplinary, multi-jurisdictional system to establish an information base for the Greater Toronto Bioregion. It would gather, synthesize, and interpret information about the physical and natural environments, as well as the social and economic characteristics of the region.

Thinking Ahead — Policies, Planning and Environmental Assessment

Ideally, environmental considerations should be included at all stages in government decision-making and within each jurisdiction: in policy development, strategic planning, regional planning, city planning, zoning designations, and project siting and design.

There are specific environmental protection policies at different levels of government: federal examples include the *Water Policy* and the *Policy for the Management of Fish Habitat*. Under the provincial *Planning Act*, the Province of Ontario has so far issued several policy statements affecting natural and physical environments; they cover mineral resources, floodplain planning, foodlands and wetlands. However only the draft wetlands policy is aimed directly at environmental protection. In addition, the Ontario MOE set up a Lakefill Policy Development Committee in March 1988. The Royal Commission, which is both a federally and a provincially sponsored body, is currently conducting a study of shoreline regeneration, which includes examining lakefill issues, as a possible basis for public consultation on these matters.

Figure 21 Hierarchy of decision-making

The City of Toronto's 1989 report, *The Changing Atmosphere: A Call to Action*, provides a policy framework for local, municipal action to reduce emissions of air pollutants and to adapt to climate change. It also calls for federal and provincial leadership, specifically for tightening of federal emissions regulations, enforcing federal standards, and setting up adequate provincial monitoring programs. It is worth noting that the City's leadership in environmental issues was a factor in the recent decision by the International Union of Local Administrators to choose Toronto as headquarters for a major new international agency, the International Council for Local Environment Initiatives.

While it is important to develop specific environmental policies, it is equally necessary to examine the environmental implications of other proposed government policies. The World Commission on Environment and Development (which produced the so-called "Brundtland Report") recommended that the scope of environmental assessment be broadened to include all policies and programs that could have a significant influence on the environment. Consistent with *Canada's Green Plan*, the federal government will now consider the environmental impact of all proposed program and policy initiatives, and will make the results public.

Under the provincial *Planning Act*, the environment may be, but is not required to be, a consideration in municipal planning. Increasingly, however, municipalities now tend to integrate environmental concerns into

their official plans. For example, Metropolitan Toronto's official plan review program includes a component on the "livable metropolis", which focusses on the relationships among three dimensions of city life: environmental integrity, social well-being, and economic viability. And the City of Toronto's revised official plan, *Cityplan '91*, will include a major emphasis on the environment.

Nonetheless, many decisions on official plan amendments, subdivision approvals, site plans, and the like are being made without regard to the impact projects have on the environment, and do not consider cumulative effects (for example, of many separate suburban developments on downstream water quality and stormwater fluctuations in the rivers). The Royal Commission, in collaboration with various levels of government, is currently conducting a study of methods for assessing the cumulative effects of development on the environment in the Greater Toronto Bioregion. It will examine how assessment of cumulative effects can be integrated into current municipal planning processes, environmental assessment, and remedial action planning.

Many aspects of the process by which municipalities control and approve of developments do not require environmental review. This is generally because these processes — zoning designations, subdivision approvals, and development and building permit applications — were established at a time when environmental matters were deemed less important than they are today. For example, under the *Planning Act*, zoning by-laws convey specific rights to landowners regarding the use of their lands; this limits municipalities' ability to comment on environmental conditions when reviewing site plans and drawings or building permit applications, and may lead to situations like that of the Keating Channel Entry Park, described earlier in this chapter.

Clearly, an ecosystem approach to land-use planning and development will require not only a "greening" of the *Planning Act*, but also of the policies and regulations enacted under it, and of the departments that carry out municipal planning and development control. The Ontario Ministry of Municipal Affairs is currently working on several programs to address these issues. In addition, in the spring of 1991 a multi-disciplinary Royal Commission work group on "Integrating Environmental Considerations in Land-Use Planning", composed of experts from the public and private sectors, will publish a report designed to be the basis for public consultations on these critical issues.

In practice, most attention to environmental effects is focussed on the outcome of all the previously described processes — the project itself. Assessment of the impact of a development on the environment is based on the environmental assessment programs spelled out in the federal *Environmental Assessment and Review Process* and the provincial *Environmental Assessment Act*.

The federal *Environmental Assessment and Review Process (EARP)*, which applies only to federal projects, is based on an Order-in-Council and not on legislation, although a draft bill to legislate federal environmental assessment was recently tabled (see below). Until recent court decisions established that the federal government is required to carry out environmental assessments of major projects, there was considerable discretion in deciding whether any given one should be assessed. Some observers have said that the convoluted tale of the Rafferty-Alameda Dam suggests that the government is having difficulty applying its own laws and guidelines.

Although itself a federal body, the Board of Toronto Harbour Commissioners (THC), is not subject to the *EARP*. However, before constructing the Outer Harbour Marina, the THC did undertake a voluntary initial assessment under *EARP*, although it was not adequate to evaluate fully the possible effects of the project. In particular, the assessment did not look at the impact on

aquatic biota or aquatic habitat, and had limited information on the effects on water quality or circulation in the Outer Harbour during construction or during the lifetime of the marina.

In June 1990, the federal government tabled *Bill C-78*, the proposed *Canadian Environmental Assessment Act*, in the House of Commons. As written, the draft bill addresses some of the key shortcomings of the existing assessment process: in particular, it requires assessment of major projects, formalizes the public review process, provides for intervenor funding, requires assessment of cumulative effects, requires follow-up monitoring, and places the federal Review Office and Hearing Panels at arm's length from the government. However, the Royal Commission's environmental audit team is concerned that *C-78* still excludes a variety of Crown corporations and harbour commissions, including the Toronto Harbour Commissioners, from compliance with the legislation.

Outer Harbour Marina

A submission of the Environmental Assessment Caucus (1990) notes some other weaknesses of the bill: it does not require an assessment of the need for a project nor examination of alternatives to it; the scope of matters to be assessed has been restricted from "proposals" (as under *EARP*) to "projects"; and there is too much discretion, without specified criteria, for decisions about exemptions, levels of assessment, and other matters.

In Ontario, provincial and municipal projects are subject to the provincial *Environmental Assessment Act (EAA)*, which is designed to ensure that a project's impact on the environment is considered, along with alternatives, before approvals are given to start building. However, exemptions are granted so frequently that some have dubbed it the "Environmental Exemption Act": from 1983 to 1990, according to a report of the MOE, *Toward Improving the Environmental Assessment Program In Ontario*, 150 exemptions were granted out of a total of 180 requests. In addition, the *EAA* does not apply to private-sector projects, unless they are for waste disposal, or unless they are specifically designated by the Minister of the Environment. The *EAA* is currently being reviewed under an Environmental Assessment Program Improvement Project (EAPIP) which is examining possible improvements.

One important initiative in the East Bayfront/Port Industrial Area is the upgrading and expansion of the Main Sewage Treatment Plant (STP), which is subject to the provincial environmental assessment process. All municipal sewage and water projects, including expansion and construction of sewage treatment plants, are subject to the *Class Environmental Assessment for Municipal Sewage and Water Projects*. Because the STP expansion being considered would take the plant beyond its rated (i.e., approved) capacity, and possibly beyond current site boundaries, it is considered a Schedule C project under the Class

Main Sewage Treatment Plant

Environmental Assessment, and must, therefore, undergo the most rigorous review process available.

The Main Sewage Treatment Plant is now operating close to capacity, and expansion is required to accommodate increased flows due to anticipated increases in population and water consumption. Expansion will also allow more treatment of wastewater from combined sewer overflows, and will reduce primary and secondary bypasses during rainfalls. Such additional treatment should improve nearshore water quality in Ashbridge's Bay and in the vicinity of current combined sewer overflow outfalls along the waterfront and river valleys of the Main STP service area. However, it will increase total loadings to Lake Ontario discharged by the treatment plant's outfall.

A further consideration is Ontario's MISA (Municipal-Industrial Strategy for Abatement) process, which will eventually set tough new standards for sewage treatment plant discharges, to be met by all municipalities. It is unclear whether predictions can be made about future effluent targets required under MISA, and whether the upgrading and expansion of the Main STP can (or should) be undertaken to meet those targets.

Many members of the public have expressed concerns regarding increased air emissions from the Main STP, and the effects of any lakefilling that may be required to enlarge the site. Air emissions may increase if incineration is used to dispose of the increased volumes of solids remaining after treatment of the increased sewage flows in the service area of the Main STP and the Humber STP (sewage sludge from the Humber STP is currently transferred to the Main plant for incineration, and the amount is to be increased in the future). If lakefilling at the southern edge of the plant is considered the preferred means of enlarging the site, it will be assessed for its potential effects on shoreline currents, sediment deposition, and water quality.

The Class EA (Environmental Assessment) process is generally applied to classes

of activities in which the impact on the environment is minor, predictable, and relatively similar from case to case. In contrast, Metro's Class EA of the Main STP has a very broad scope, including both expansion (to meet future population growth and to treat combined sewer overflows) and upgrading (to firm up capacity to treat present inputs). Although Metro expects that expansion of the Main STP will be necessary, a broad range of alternative solutions is being considered. Options include water conservation measures, diversion of flows to other plants, and means of reducing the stormwater component of combined sewer flows. In addition, alternatives to chlorination for disinfection, to incineration of sludge, and to lakefilling will be studied.

The breadth and scale of these issues have caused some people to question whether an individual environmental assessment, rather than a class environmental assessment, should be undertaken. Under the former, there is formal review by government agencies following submission of the EA document, and the Minister of the Environment makes the decisions about acceptability of the document and approval of the undertaking. There is an opportunity for a public hearing, with intervenor funding available to public groups. Under the *Class EA for Municipal Sewage and Water Projects*, there is no formal government review of the environmental study report. Public consultation is provided during the assessment process, but there are no provisions for public hearings.

However, it is important to note that sewage treatment plant expansions are explicitly included in the *Class Environmental Assessment for Municipal Sewage and Water Projects*, which was approved by the Minister of the Environment in conjunction with the Municipal Engineers Association. The Class EA process provides protection for opponents of particular projects, who may request that the Minister of the Environment bump up a project to individual EA status if there are unresolved concerns at the end of the Class EA process.

A request of that nature was made by the Community Advisory Board of the City of Toronto Department of Public Health's Eastern Health Area on 10 May 1990, but was denied by the then-Minister of the Environment, who decided that it was premature to rule on the need for an individual environmental assessment. The Minister pointed out that a more appropriate time to request a bump up would be after the submission of the environmental study report, which is expected in September 1991.

It remains to be seen whether the environmental study report adequately addresses public concerns about the environmental effects of expansion of the Main STP, assuming that expansion is determined to be the preferred solution to the problem. However, it appears that some of the questions about the project that are now being raised by members of the public are beyond the scope of the assessment of the treatment plant itself. There are many related initiatives under way, for example: a new City of Toronto Sewer System Master Plan, Metro's study on the mid-Toronto interceptor sewer, Metro's study of the Don Sewer System, Metro's physical audit of the North Toronto STP, and the Metro Toronto Remedial Action Plan (RAP).

As Figure 22 shows, the service area for the Main STP includes not only most of the City of Toronto, but also the Borough of East York, City of North York, and parts of the City of Scarborough (a total population of 1.2 million people). In the absence of an overall master plan encompassing all the local and Metro components of the sewage system, it is difficult to undertake planning, and the public consultation that accompanies it, for a specific facility such as a sewage treatment plant. The case of the Main STP is an example of the need to have a comprehensive, environmentally based planning framework, understandable to the layperson, before embarking on individual projects.

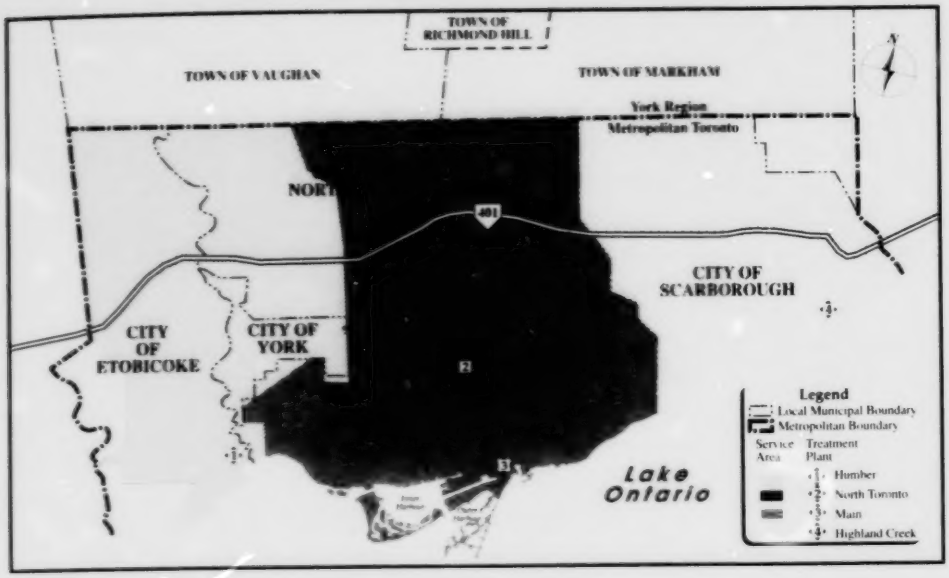


Figure 22 Sewage Treatment Plant service areas

A Role for People: Public Involvement

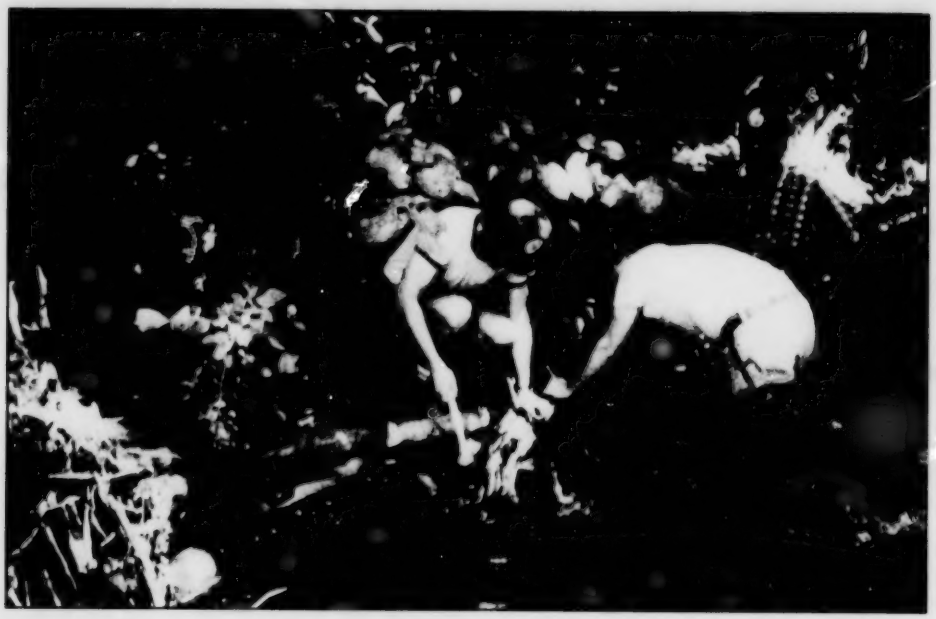
In the Royal Commission's view, stewardship includes giving members of the public an important role as watchdogs, educators, researchers, and advocates for the environment. They should also be part of the process of determining values and desired future uses for the East Bayfront/Port Industrial Area. There are four critical needs if the public is to carry out its role: adequate and meaningful opportunities for public involvement; access to information; the power to contribute to decisions; and the legal and financial means to act independently in the courts, if necessary.

One way to meet some of these needs, as the Royal Commission recommended in its *Watershed* report, is to have the Province encourage and assist in forming a citizens' coalition for the waterfront, to provide research and advocacy on behalf of waterfront users, and to help ensure that issues that cross traditional jurisdictional boundaries are addressed.

The Commission has involved the public in the environmental audit through its formal hearings, through ad hoc meetings with interested groups and individuals, and by including public representation in its work groups. This process of involvement has contributed substantially to the value of the audit.

Although public involvement is seen increasingly as a fundamental part of environmental planning and assessment, its use in other areas, such as policy-making and development of standards, is uneven. Until the provincial MOE set up an Advisory Committee on Environmental Standards (ACES), the public was not involved in the standard-setting process. It is partly for this reason that people questioned the adequacy of standard-setting in general. Public involvement through ACES should begin to address this problem at the provincial level.

The public can be a rich source of ideas, opinions, and feedback. Nonetheless, effective public involvement, by its nature, can be time-consuming for all those involved. Sitting on a stakeholder committee or a public advisory committee in a process such as



Public involvement in river rehabilitation

a remedial action plan, a waste management plan or a pre-submission consultation for an environmental assessment may require many hours of work over long periods. In most cases, the contributions made by members of the public are not recognized by per diems, or even reimbursement for travel expenses.

The effectiveness of members of the public as watchdogs for the environment is often restricted by a lack of easily available information. In some cases, this occurs because jurisdictional fragmentation makes it difficult to understand who is in charge, and where information can be found. Sometimes, the information simply does not exist. For example, members of the public participating in the environmental audit have raised excellent questions — unanswerable at present because of gaps in the data base.

The ability of workers to "blow the whistle" when they observe their company violating regulations is constrained by the fear that they may lose their jobs if they report an infraction to the government. The Environmental Bill of Rights proposed by the Ontario Minister of the Environment on 13 December 1990 should help to address this and related issues. It is expected to include measures to:

- enshrine in law the right to a healthy environment;
- improve public access to the courts, including the right to sue polluters;
- increase public participation in environmental decision-making;
- increase government responsibility and accountability for the environment;
- increase protection for employees who "blow the whistle" on polluting employers.

Conclusion

The environmental audit has revealed that current approaches to stewardship and accountability present obstacles to achieving greater ecosystem integrity. In the course of

the audit, a number of examples of positive efforts to overcome such barriers were discussed. Some, such as creating co-ordinating mechanisms within a particular jurisdiction, are relatively simple. Others may require major changes in legislation, regulations, and decision-making processes. It was well articulated by the authors of *Towards an Ecosystem Charter for the Great Lakes*, who said, reflecting on the need for fundamental changes to address social, political, and institutional issues:

> This challenge is indeed a great one, and will demand a new level of co-operation, commitment, and institutional innovation within the Great Lakes Basin. Can we afford not to accept this challenge?

CHAPTER FIVE

OPPORTUNITIES

The environmental audit began with five key questions, which were discussed in Chapter 1 of this report:

1. What are the environmental conditions in the study area?
2. What relationships exist among the environments of the study area and the City of Toronto, the Don watershed, the Greater Toronto Bioregion, and the Great Lakes Basin?
3. What are the implications of the environmental conditions in the area for the health of the ecosystem, including human health?
4. How are human activities affecting other elements of the ecosystem (air, land, water, and wildlife)?
5. What measures are necessary to re-establish ecosystem integrity and restore beneficial uses?

Chapters 2, 3, and 4 addressed the first four questions by summarizing our present understanding of the integrity of the ecosystem of the East Bayfront/Port Industrial Area. The interactions among natural and cultural systems were discussed as they affect habitats for wildlife and humans, and the physical health of the ecosystem. The consensus was that, overall, the ecosystem in the study area is dis-integrated, and shows various symptoms of ill health. Some parts of the area, however, particularly along the north shore of the Outer Harbour, are surprisingly healthy in terms of the variety and abundance of wildlife and the quality of recreation opportunities.

This analysis of the ecosystem provided valuable information that can be used to address the fifth question and contribute to future decision-making for the area. It showed:

- significant values that could be protected;
- potential opportunities for enhancement;
- environmental problems that require remediation;
- barriers to ecosystem integrity;
- a need for land- and water-use planning that respects environmental conditions;
- opportunities to conduct human activities in a more environmentally responsible way;
- areas of study requiring further research.

The purpose of this chapter, therefore, is to use current understanding of the ecosystem as a basis for proposing measures that will re-establish ecosystem integrity and protect and restore beneficial uses.

A Vision for the Future

The Royal Commission's second interim report, *Watershed*, recommended some major changes in managing the East Bayfront/Port Industrial Area that could pave the way for improved ecosystem integrity. Among them:

- consolidation of the Port;
- expansion of waterfront parklands;
- creation of a Don Valley wildlife corridor;
- revitalization of waterfront industry by the Toronto Economic Development Corporation (TEDCO);
- a Centre for Green Enterprise and Industry;
- a Toronto Waterfront Regeneration Land Trust.

The Commission intends the ecosystem approach to be applied to these initiatives, incorporating and extending the information base developed during the environmental audit. This will necessitate close co-ordination among the responsible agencies to ensure a comprehensive view of natural, physical, social, cultural, and economic systems.

The recommendations in this chapter are directed to specific bodies, including departments of the different levels of government

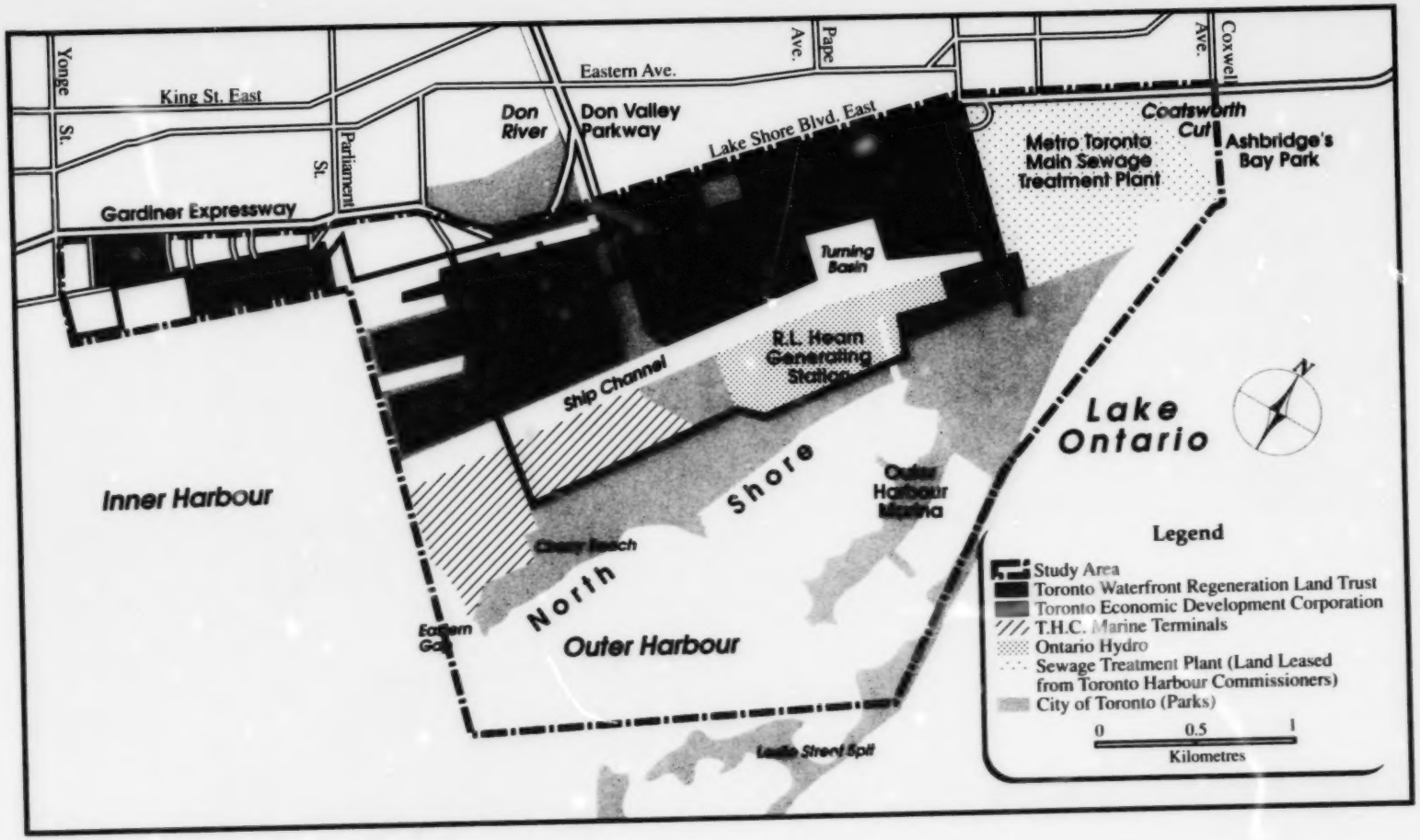


Figure 23 Proposed allocation of public lands

and other agencies. Three of these entities — the Toronto Economic Development Corporation (TEDCO), the Centre for Green Enterprise and Industry, and the Toronto Waterfront Regeneration Land Trust — are either new entities or, in the case of TEDCO, have new roles, as envisaged in *Watershed*.

TEDCO was created by the City of Toronto in 1986 and operates under a provincial charter. Its mandate is to create jobs, particularly on under-utilized or surplus City property. Its board is composed of people from the business, labour, and public sectors. Although it is fully accountable to the City of Toronto, it enjoys an arm's-length relationship with the municipality. The Royal Commission has recommended, and the City of Toronto and the Province have agreed, that TEDCO should develop the lands designated for industry in the East Bayfront/Port Industrial Area (see Figure 23).

The proposed Centre for Green Enterprise and Industry would be managed by TEDCO and run by a board comprising representatives from the business, labour, academic, and public sectors. Its mandate would be three-fold:

- to carry out research and development on the relationship between the environment and industry, and foster business and manufacturing practices and processes that are "environmentally friendly";
- to act as a centre for gathering, analysing, and disseminating environmental information;
- to provide environmental education and training to students of community colleges and universities.

In response to *Watershed*, the Province of Ontario's Minister of the Environment announced, on 17 December 1990, that the government would establish by legislation a Waterfront Regeneration Land Trust. This non-profit agency will accept lands surplus to port and industrial needs, as well as adjacent provincial lands. The Trust would be subject to all normal City of Toronto planning controls and its board would include appointees from the City, Metropolitan Toronto, and the Province. It would be legally accountable to the Province of Ontario. Its mandate would be to:

- complete the environmental audit of the provincially designated area;
- remediate all lands under its ownership and plan for a range of mixed uses.

The *Watershed* report recommended that the mandate of the Toronto Harbour Commissioners should be redefined to focus on operating the port and the Toronto Island Airport, as well as performing a range of marine engineering, harbour mastering, navigation and shipping activities along the Greater Toronto Waterfront. The THC has recently taken some noteworthy initiatives towards environmental rehabilitation, particularly with respect to soil remediation and their support of the Task Force to Bring Back the Don. Regardless of the final outcome of ongoing discussions among the levels of government about the actual disposition of the lands in the East Bayfront/Port Industrial Area, the THC will continue to bear a share of the responsibility for environmental rehabilitation in this area, in keeping with their roles as former and current land-holders. In addition, the roles of former and present tenants of the THC must be included in considering the relative responsibilities of different parties.

The Ecosystem Approach

In order to work towards ecosystem integrity, it is necessary to have some understanding of what that might look like. As described in Chapter 1, the values embodied in the *Ecosystem Charter for the Great Lakes*, the *Great Lakes Water Quality Agree-*

ment, the Metro Toronto Remedial Action Plan goals, the Healthy Communities concept, and the *Watershed* principles have contributed to our vision of ecosystem integrity for the area. This envisages an area which — expressed in terms of the *Watershed* principles — is clean, green, useable, diverse, and connected. That is, it should:

- be free of harmful levels of contaminants;
- have varied habitat to support wildlife;
- provide a healthy, safe environment for human activities;
- contribute to the economy and quality of life in the city;
- have continuity with its cultural and natural heritage.

This vision can only be implemented by taking an ecosystem approach to all future planning and management of the East Bayfront/Port Industrial Area. First, decisions about the types and distribution of future land uses should be made with full understanding of the needs of the biophysical, social, and economic elements of the ecosystem, and the interactions among them.

Second, development should incorporate the best possible means of improving and protecting ecosystem health, including:

- remediation of soil and groundwater pollution;
- building design and landscaping to improve microclimatic conditions and reduce energy use for heating/cooling;
- urban design and transportation to provide liveable, pedestrian-oriented places;
- innovative techniques for stormwater management to prevent polluted run-off and storm-sewer discharges;
- natural landscaping to provide wildlife habitat and reduce the energy, chemicals, and water needed to maintain manicured landscaping.

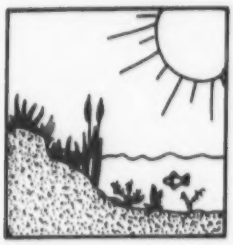
Third, all users of the East Bayfront/Port Industrial Area should be required to employ the best possible management practices to minimize harmful effects such as spills, air pollution, effluents, noise, odours, dust, etc. Closed-loop systems should be applied to the use of water, energy, and materials. This would help to reduce pollution and wastes. In addition, there are many possibilities for local initiatives, for example: composting food industry wastes for use in nearby gardens; linking industries that can use the "wastes" from one company as a resource for another; and making productive use of waste heat from industrial processes.

The following sections describe in more detail how the ecosystem approach can be applied, relate it to specific goals for the East Bayfront/Port Industrial Area, and propose measures that will lead to greater ecosystem integrity. If successful, there should be improvements in ecosystem health, evaluated in Chapter 3. For example, the diversity and abundance of wildlife species should increase, the levels of toxic chemicals in the ecosystem decline, and environmental hazards be reduced.

It should be noted that we have not used all the principles explicated in *Watershed*. The environmental audit team selected those that were appropriate to the information gathered during the audit; they relate primarily to opportunities to improve ecosystem health. The remaining principles — open, accessible, affordable, and attractive — should, of course, be incorporated into future planning and urban design for the East Bayfront/Port Industrial Area. However, the audit did not provide any information that would carry these principles beyond the proposals made in *Watershed*.

The recommendations presented here are based on the work of the environmental audit's phase II work groups. Detailed discussion of the recommendations may be found in their technical papers.

Clean

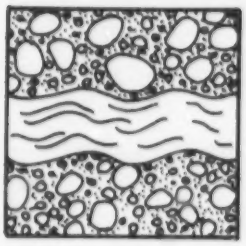


The evaluation of ecosystem health undertaken by the audit team makes it clear that the air, soils, groundwater, surface waters, and sediments of the East Bayfront/Port Industrial Area are contaminated, to varying degrees. Remedial action is required to clean up the effects of past activities, and measures must be taken to ensure that further degradation does not occur. The primary goal is to remove impairment of beneficial uses. Some specific objectives include the following:

- there should be no restrictions on fish consumption because of contaminant levels;
- there should be no beach postings due to bacterial pollution;
- there should be no measurable adverse effects of toxic chemicals on wildlife;
- sediments should meet open water disposal guidelines;
- there should be no restrictions on current or future land uses because of soil and groundwater contamination;
- air quality should meet applicable standards for all future land uses.

While these objectives cannot be met overnight, achievable targets should be set, in order to facilitate the likelihood of reaching them. This should be one of the first tasks of the Toronto Waterfront Regeneration Land Trust, undertaken in collaboration with all affected parties — government agencies, non-government organizations, industries, landowners, and the general public.

Soils and Groundwater



Tests of soils and groundwater undertaken by the Royal Commission and others show that there is contamination — in some cases relatively minor and in others very serious — at 27 of the 28 sites investigated (of a total of 123 sites in the study area). The MOE's clean-up guidelines are exceeded for a number of heavy metals. There are no provincial guidelines for specific organic compounds, but the studies show that benzene, ethylbenzene, toluene, xylene, PAHs, and PCBs are present in the soils. At some sites, groundwater is contaminated with heavy metals and organic compounds as well as free-phase floating petroleum products. Therefore, it is likely that some form of remediation will be required before many locations in the area can be redeveloped. Because some contaminants migrate from their source to adjacent sites, it will be necessary to develop strategies for cleaning up clusters of sites.

At present, there are no comprehensive guidelines to facilitate decisions about remediation. The *Guidelines for the Decommissioning and Clean-Up of Sites in Ontario* do not include all the contaminants (particularly the organic ones) found in the East Bayfront/Port Industrial Area. This same situation exists in many other places with contaminated soils. For example, the City of Toronto's proposed Ataratiri development, located just north of the study area, has soils with similar contamination problems.

The application of the Ontario guidelines is triggered by proposals for change in land use. As discussed earlier, this is not adequate to ensure that soil and groundwater conditions are addressed prior to all redevelopment activities.

Traditionally, contaminated soils have been removed from development sites and disposed of in landfill, lakefill or hazardous waste sites. With the current landfill crisis, and the growing sense of environmental responsibility among the public, it is no longer acceptable to deal with contaminated soils by simply transporting them from one place to another. Although there are a variety of techniques for cleaning soils and groundwater on-site (22 of which are described in the Phase II technical paper on *Soils and Groundwater*), many have not been demonstrated at field scale. The Board of Toronto Harbour Commissioners (THC) is currently studying the feasibility of establishing a soil recycling facility in the Port Industrial Area. The THC estimates it would cost $25 million to $30 million to construct, not including land costs. It would clean soils and groundwater contaminated with organics, inorganics, and PAHs, to a standard suitable for industrial uses.

Recommendations:

1. **The Toronto Waterfront Regeneration Land Trust, in consultation with all affected parties, including the public, should develop a remediation strategy for the entire East Bayfront/Port Industrial Area, based on the information amassed during the environmental audit. That strategy should include provisions for site-specific studies, research on groundwater movement and contamination, the development of comprehensive guidelines and demonstration of clean-up techniques, as described in recommendations 2 to 5. The Land Trust should then proceed to remediate the lands under its ownership and coordinate remediation of sites in the rest of the East Bayfront/Port Industrial Area.**

2. **Detailed, site-specific investigations of soil and groundwater quality should be undertaken before decisions are made on the amount and type of remediation required for proposed land uses. This should be done by the owner and/or tenant of each site prior to sale or redevelopment.**

3. **The Toronto Waterfront Regeneration Land Trust should carry out further research to provide a better understanding of groundwater movement and contaminant sources. In particular, groundwater levels should be monitored adjacent to the harbour to establish the relationship between groundwater levels and lake levels, and groundwater contaminant sampling should be undertaken to determine the variability of concentrations over a period of time.**

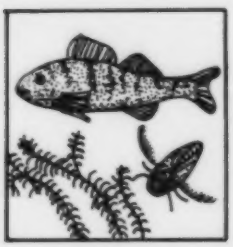
4. **The Toronto Waterfront Regeneration Land Trust, in consultation with the Ontario Ministry of the Environment, the City of Toronto, those responsible for cleaning up, and the public, should develop comprehensive, numerical clean-up guidelines that can be applied to the East Bayfront/Port Industrial Area. These guidelines should be applied in all cases of redevelopment and should be based on a wide range of considerations, including:**

    - **environmental mobility of each contaminant;**
    - **risks to human health;**
    - **risks to plants and animals;**
    - **anticipated future land uses;**
    - **possible synergistic or antagonistic effects;**
    - **soil characteristics;**
    - **groundwater systems;**
    - **background levels;**

- **aesthetic considerations;**
- **compatibility with other relevant environmental guidelines.**

5. **The Toronto Waterfront Regeneration Land Trust should coordinate and promote research, demonstration, and evaluation of soil and groundwater remediation techniques. Research institutions, government agencies and the private sector could be included in collaborative work. The feasibility of building a mobile or fixed facility for cleaning soils and groundwater of the East Bayfront/Port Industrial Area and the Ataratiri site should be investigated.**

Aquatic Environment



Water and sediment quality varies across the East Bayfront/ Port Industrial Area. In general, there is serious degradation in the Keating Channel, Inner Harbour, Ship Channel, and Coatsworth Cut. The Outer Harbour is relatively clean, but far from pristine. The problems of the aquatic environment include high levels of nutrients, highly contaminated sediments in some areas, occasional exceedances of heavy metals in surface waters, and contaminants in wildlife.

Across the study area, toxic chemicals are found in aquatic biota including benthic organisms, fish, and aquatic birds. Birth defects due to persistent organochlorines have been noted in aquatic birds from nearby areas; the effects of contaminants on other aquatic biota are not known. There are restrictions on eating some sizes of eight species of fish taken from the study area.

Some remedial actions are being undertaken under existing municipal, regional, and provincial programs, primarily to reduce bacterial pollution. They include establishing a detention tank in the Eastern Beaches to hold stormwater for treatment at the Main Sewage Treatment Plant, as well as sewer separation programs and improvements to the plant itself. In addition, the federal and provincial governments are developing the Metro Toronto Remedial Action Plan (RAP), which will recommend remedial actions for restoration of the aquatic environment along Metro's waterfront. Work on this project has been under way since 1986 and is expected to be completed in 1992.

In its *Watershed* report, the Royal Commission commented on the Remedial Action Plan and recommended that it:

- involve all the municipalities in Metro Toronto more fully;
- organize the process using a watershed approach;
- rewrite the Draft Discussion Paper on Remedial Options to make it more readily understandable to the public;
- provide more funding and resources for the RAP Public Advisory Committee;
- incorporate the RAP, when completed, in the proposed Waterfront Partnership Agreements.

Successful completion of the Metro Toronto RAP is vital to a healthy waterfront and to an improved aquatic environment in the study area. However, progress on the RAP has been painfully slow.

Once implemented, the Metro Toronto RAP will need accurate baseline data against which to measure progress. However, the environmental audit revealed that the information base on the aquatic environment in the study area — indeed, across the waterfront — is inadequate to provide a clear picture of the current situation or changes over time. The monitoring that has been carried out is inconsistent with respect to sampling locations, sampling periods,

Collection of fish by seine netting

parameters analysed, and methods; moreover, little or no information has been collected on some components of the aquatic ecosystem. This makes it difficult to assess trends or to gain a full understanding of the health of the aquatic environment.

The greatest single source of heavy metals and organic chemicals in the study area (and the Metro waterfront) is the Main Sewage Treatment Plant. Metals and chemicals are dumped into the sewer system by thousands of "upstream" industries — electroplaters, photofinishers, product manufacturers, and others — and thousands of households. The chemicals interfere with the functioning of the sewage treatment plant, cause corrosion in pipes, may affect workers at the plant, and — because sewage treatment plants are not designed to remove them — pass largely unmodified through the plant.

Metro Toronto is currently conducting an environmental assessment under the *Class Environmental Assessment for Municipal Sewage and Water Projects* to expand and upgrade the Main Sewage Treatment Plant. Although the upgrade and expansion will dramatically improve bacteriological quality along the waterfront, it cannot improve the situation with respect to heavy metals and organic chemicals.

However, the provincial MISA (Municipal-Industrial Strategy for Abatement) is intended to deal with the problem, and will do so in two ways. First, MISA will require Best Available Technology (Economically Achievable) for sewer dumpers (or indirect dischargers, as they are known). Second, it will set tough new performance standards for sewage treatment plants. However, in the first four years of its existence, the MISA program has focussed on direct dischargers (larger industries that send effluents directly into water bodies), and alarmingly little progress has been made by the Province on indirect dischargers or the municipal sector.

Recommendations:

6. **Because of the vital importance of preparing and implementing the Metro Toronto Remedial Action Plan as soon as possible, Environment Canada and the Ministry of the Environment should give higher priority to the Metro Toronto RAP and should divert additional resources and funds to ensure that it is completed as quickly as possible.**

7. **As part of the Metro Toronto Remedial Action Plan process, the federal and provincial governments should immediately begin to coordinate development, funding, and implementation of a comprehensive monitoring program for the Toronto waterfront. Such a program should include monitoring of ambient water quality, water circulation and residence times, sediment quality, uptake of contaminants by biota, and effects of contaminants on biota.**

8. **The provincial government should direct additional resources and funds to the MISA (Municipal-Industrial Strategy for Abatement) program to ensure that regulations for indirect dischargers and the municipal sector are developed and implemented as soon as possible.**

Air

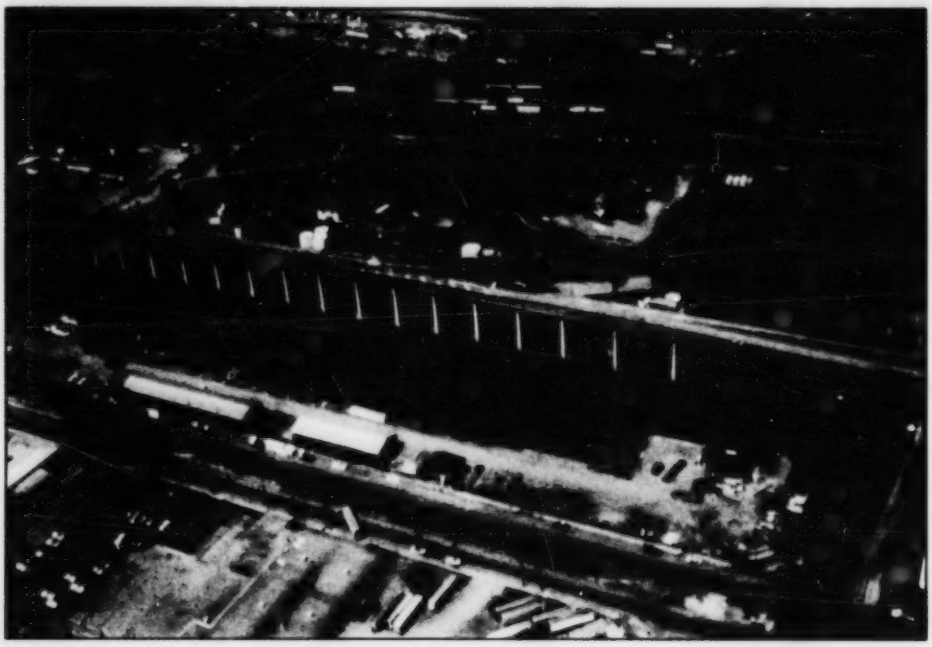
As is typical in industrial areas, the atmospheric environment of the East Bayfront/Port Industrial Area is relatively poor. Odours from the East Bayfront/Port Industrial Area are a problem for nearby residents, and fugitive emissions of dust, volatile organic compounds, and metals from industry and traffic are a concern. Near the Gardiner/Lakeshore Corridor exceedances of provincial guidelines are likely for carbon monoxide, suspended particulates, and dustfall. Little is known about emissions or levels of trace organic compounds in the air. Preliminary modelling was carried out during the audit to better characterize the atmospheric environment in the area, but improved modelling is still needed.

The East Bayfront/Port Industrial Area is subject to noise — primarily from traffic in the Gardiner/Lakeshore Corridor and the Toronto Island Airport flight path — at levels that exceed guidelines for residential uses. (However, mitigation measures can be used in building design to reduce some of the effects of noise.) As mentioned in Chapter 3, future changes in the flight paths to the Toronto Island Airport may redirect more flights over the Port Industrial Area. A study of the Toronto Island Airport currently being undertaken for the City of Toronto includes predicting the impact (including noise) of various levels of airport development and air service on the surrounding areas. The study does not involve any testing of actual noise levels.

Recommendations:

9. **Redevelopment in the East Bayfront/Port Industrial Area should be planned to take into account current and future noise and air pollution levels.**

10. **The goals of future transportation initiatives should include reduction of noise and improvements to air quality.**



Gardiner/Lakeshore corridor

11. **Within the next year, the Province, in consultation with the City of Toronto, should undertake a special study, using a mobile air monitoring facility, to measure levels of toxic contaminants in the air of the study area, in order to obtain information on human exposure.**

12. **Within the next year, the federal and provincial governments, in consultation with Metro Toronto and the City of Toronto, should carry out a survey to assess air quality in the vicinity of the Gardiner/Lakeshore Corridor.**

13. **The federal and provincial governments, in consultation with the City of Toronto, should undertake further air quality modelling of the area, based on a joint study to better assess air emissions. The federal government should continue improving the Eastern Headland Meteorological Station's archives, access to them, and their quality in order to provide improved wind data. To obtain the meteorological data needed for modelling near the lake, the provincial and federal governments should consider setting up a joint upper air station at Toronto Island Airport.**

14. **To evaluate the noise created by existing and future transportation activities (especially in the Gardiner/Lakeshore Corridor and the Toronto Island Airport) the federal and provincial governments, in consultation with Metro Toronto and the City of Toronto, should undertake a study of noise levels from a network of stations in the East Bayfront/Port Industrial Area.**

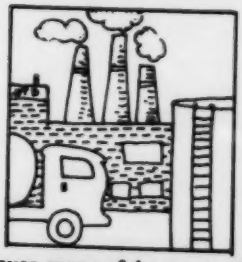
15. **If it is decided to include residential uses in the East Bayfront/Port Industrial Area, the federal and provincial governments, in consul-**

tation with the City of Toronto, should establish a continuous air monitoring station to monitor levels of all pollutants in the area (including toxics), to measure compliance with Ontario standards, and to identify any problems that may occur.

Useable

The East Bayfront/Port Industrial Area is used for port activities, industry, storage, commerce, offices, and recreation. Its potential for these uses is not fully realized at present: it provides only about 10,000 jobs, and much of the land is vacant or under-utilized. The Royal Commission believes that the area offers tremendous opportunities for revitalization, with mixed uses as well as new industries. This offers great employment potential: the City of Toronto estimates that the area could provide as many as 35,000 jobs. Information from the environmental audit can provide guidance in planning new and traditional uses in ways that contribute to ecosystem integrity.

Industries



Industries have traditionally been viewed as dirty, smelly, and noisy — best left "out of sight, out of mind". However, many of the most polluting industries have left, or are planning to leave, the East Bayfront/Port Industrial Area. Of those that remain, many are adopting more environmentally sustainable methods of operation, in response to changing public attitudes towards the environment, employee concerns for health and safety, and increased government regulation.

Watershed's proposed Centre for Green Enterprise and Industry and the work of the Toronto Economic Development Corporation offer opportunities to attract new "green" enterprises to the area. These might include manufacturing of environmentally useful products (such as energy-efficient appliances or water-conserving devices), pollution prevention technology, different forms of recycling and waste exchange, film-making, telecommunications, marine services, and the like.

Although industries are becoming much more compatible with other urban activities, there may always be some aspects of their operations (such as heavy truck traffic, risks from hazardous materials, odours, and noise) that will require that more sensitive uses be separated or buffered from them.

The environmental audit shows that, as is typical of any industrial area, there are several thousand hazardous materials in use, transit or storage in the area. This suggests that: a) industries should use the best possible management practices to avoid workplace exposures or the release of hazardous substances to the outside environment; b) care should be taken during decommissioning of sites to ensure that hazardous materials are properly disposed of before redevelopment occurs; and c) effective emergency response programs should be put in place.

Recommendations:

16. **In addition to remediating soils and groundwater, as discussed earlier, the Ontario Ministry of the Environment, in co-operation with the Toronto Waterfront Regeneration Land Trust and the Toronto Eco-**

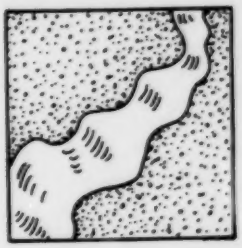
nomic Development Corporation, should ensure that owners or tenants undertake thorough decommissioning and clean-up of plant, equipment, buildings, storage tanks, and underground pipelines before leaving the area or undertaking redevelopment.

17. **The Toronto Waterfront Regeneration Land Trust and the Toronto Economic Development Corporation should undertake monitoring and education programs to ensure that industries remaining in or coming into the East Bayfront/Port Industrial Area use the best possible management practices. This should apply to control of dust, noise, and odours; management of stormwater; handling of hazardous materials; and workplace health and safety. Environmental performance standards should be incorporated into lease agreements.**

18. **The City of Toronto should ensure that there are adequate transition areas to provide a buffer between industry (including the Main Sewage Treatment Plant) and any sensitive uses in the East Bayfront/Port Industrial Area. Depending on the situation, these areas could consist of various forms of open space, such as the proposed wildlife corridor, or "neutral" uses such as offices.**

19. **Emergency response departments (police, ambulance, fire) and the Metro Toronto Emergency Planning Committee should be consulted when plans are being made for future uses of the East Bayfront/Port Industrial Area. This will ensure that adequate attention is given to efficient ways of getting in and out of the area; that adequate information is provided about the hazardous materials being used or stored on local sites; and that hospital and other emergency services are available.**

Don River



The Lower Don area would be subject to severe flooding in the event of a storm of the magnitude of Hurricane Hazel; Figure 10 (Chapter 2) shows the estimated extent of such flooding. Under the provincial *Flood Plain Planning Policy Statement*, proposals to provide flood protection for this area are being considered by a Special Policy Area Committee. The committee is chaired by the Ministry of Municipal Affairs, and includes representatives from the Ministry of Natural Resources, Ministry of the Environment, Metropolitan Toronto and Region Conservation Authority, Metropolitan Toronto, and the City of Toronto. Although its main focus has been on the future Ataratiri development, the committee is also considering flood protection in the rest of the flood-prone area. Among the flood protection measures being considered: continued dredging of the Keating Channel, placement of fill along the eastern edge of Ataratiri, widening of the Canadian National Railway bridge, and excavation of a floodway along the west side of the Don River.

A Strategy for the Lower Don now being prepared for the City of Toronto's Task Force to Bring Back the Don may result in recommendations that a new mouth be created for the Don River — a move that would have possible implications for land use and design in the East Bayfront/Port Industrial Area.

Recommendations:

20. **Comprehensive planning for flood protection should include the entire flood-prone area. To facilitate flood protection for the East Bayfront/Port Industrial Area, the Toronto Waterfront Regeneration Land Trust should be included in the Special Policy Area Committee. Because there will be many beneficiaries of flood protection measures (land in the area is owned by all four levels of government and the private sector), a joint funding agreement should be developed.**

21. **Plans for future uses of the East Bayfront/Port Industrial Area should take into account the need for flood protection and the possibility that a new mouth will be created for the Don River.**

Green

The East Bayfront/Port Industrial Area presents two strikingly different pictures of terrestrial wildlife habitat: while buildings, storage facilities, and bare ground in the industrial areas provide habitat for very few species, the north shore of the Outer Harbour and some vacant lots in the industrial areas, have developed comparatively rich and diverse wildlife habitats — largely without human intervention. The contrasts in aquatic habitat are also quite dramatic: from the limited habitat of the Keating Channel, Inner Harbour, and Ship Channel to the more varied and productive Outer Harbour. Connections with habitats in the Don Valley and the Leslie Street Spit are poor.

The *Watershed* report recommended more parkland in the Port Industrial Area, as well as a wildlife corridor to connect it with the Don Valley; it also called for adoption of an ecological approach to open space, where possible. There is particular potential in the study area to:

- protect existing wildlife habitat;
- enhance wildlife habitat;
- develop connections with the Don Valley, Ashbridge's Bay, and the Leslie Street Spit.

These three steps would help restore ecosystem health by revitalizing habitats, expanding wildlife diversity and abundance, increasing the complexity of the food web, and improving opportunities for migrating species. They would provide a green framework for future economic development in the area, as well as enhanced opportunities for recreation close to the City.

The key areas of natural terrestrial habitat worth protecting are indicated on Figure 24. They comprise land on the north shore of the Outer Harbour south of Unwin Avenue, at the base of the Spit, and in two large vacant lots between the Don Roadway and Saulter Street, north of Commissioners Street. They have rich habitats and abundance of wildlife because natural vegetation has been allowed to develop without planting or management and because they have not been excessively disturbed by human beings.

To find out whether clean-up is required, the natural habitat areas will have to be investigated further for contamination of soils and groundwater. Although there is no information on possible effects on terrestrial wildlife through uptake of contaminants by plants and animals in the food web, a dense cover of vegetation may provide good protection against potential human exposure to contaminated soils. Therefore, it is worth considering whether to leave well-vegetated

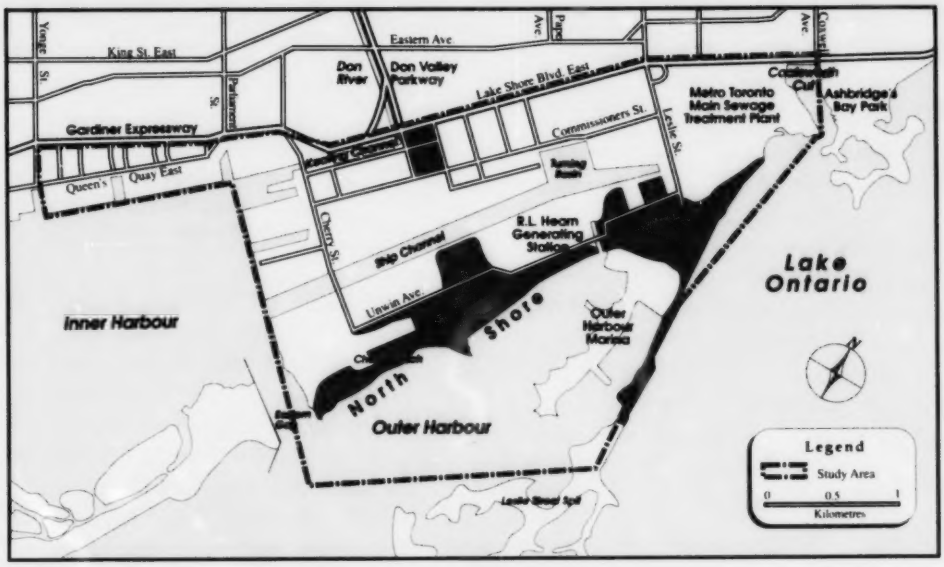


Figure 24 Terrestrial habitat areas worth protecting

sites alone, rather than incurring the financial costs and ecological disruption associated with soil remediation. However, if mobile contaminants in groundwater are found to be migrating to adjacent sites, beach areas or the harbour, remedial action will be required.

Recommendations:

22. Planning by the City of Toronto for future recreation in, and access to, open spaces in the East Bayfront/Port Industrial Area should attempt to strike a balance between increasing the opportunities available for people and limiting disturbance of wildlife. This can be achieved by careful siting of recreation facilities, leaving some areas without access trails, and providing for a limited range of activities compatible with, and dependent on, the natural values of the area. The present uses of the area — nature observation, walking, cycling, picnicking, swimming, and boating — are good examples of appropriate activities.

23. The City of Toronto, which will have new parkland in the area, should protect existing natural habitat on the north shore and, if possible, in the vacant lots north of Commissioners Street. On the whole, the vegetative cover should be left to develop naturally. However, it is important to remember that the present diversity of habitats is a reflection of the presence of many stages of succession (e.g., from open field to pre-woodland to woodland). Left alone, much of the land in the earlier stages of succession will eventually be replaced by woodland. A management strategy could be developed to provide for occasional mowing or thinning of vegetation to maintain the earlier stages of succession in selected locations.

24. The Toronto Waterfront Regeneration Land Trust and the City of

Current conditions of the North Shore aquatic habitat

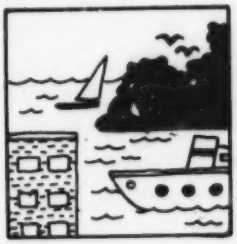
Potential enhancement of the North Shore aquatic habitat

Toronto, with funding and co-operation from present landowners, should undertake detailed studies of soil and groundwater quality, contaminant migration, and contaminant uptake by wildlife, and develop a soil management strategy for natural habitat areas. The studies should explore the possibility of leaving well-vegetated locations alone, unless there is evidence that contaminant uptake is causing adverse effects in wildlife or that contaminants are migrating to areas where humans may be exposed to them or where they may adversely affect aquatic habitats in the Outer Harbour.

25. **The diversity and quality of terrestrial and aquatic habitats should be increased. This should be undertaken as a partnership of the City of Toronto, the Metropolitan Toronto and Region Conservation Authority, the Ontario Ministry of Natural Resources, and the federal Department of Fisheries and Oceans. The Toronto Waterfront Regeneration Land Trust, Toronto Economic Development Corporation, and other landowners should also be involved. Wetlands and ponds could be re-created in open spaces to replace some of the Ashbridge's Bay marshes that were filled in to create the Port Industrial Area. Aquatic habitat could be improved by placing rock piles and tree crowns in the Outer Harbour to increase structural diversity. Wherever possible, native species of vegetation should be planted, to replace formal landscaping: for example, the lawns surrounding the Main Sewage Treatment Plant could be transformed to woodland.**

26. **The City of Toronto should create wildlife corridors linking the north shore of the Outer Harbour to the Don Valley, Leslie Street Spit, and Ashbridge's Bay Park. These should be wide enough to provide buffers between wildlife and adjacent human land uses. Native plants should be used as part of a naturalization process that encourages the ecological development of vegetation. Connections for wildlife movement through the Don Valley should be developed in association with the City of Toronto's Task Force to Bring Back the Don.**

Diverse



The *Watershed* report recommends that the waterfront provide a mix of uses, activities, and experiences; such diversity works best when different areas along the waterfront have distinct characters. The East Bayfront/Port Industrial Area contributes to the diversity of the Toronto waterfront by providing port and industrial opportunities, valuable wildlife habitats, and opportunities for water-related and nature-oriented recreation.

Recommendation:

27. **All parties involved in future planning and design in the East Bayfront/ Port Industrial Area should strive to maintain and enhance its distinctive sense of place. This means strengthening its industrial and port character where appropriate, keeping links with its heritage (as discussed in the following section), and enriching the natural character of the open spaces.**

Connected

The *Watershed* report recommended that waterfront habitats and uses be linked — connected — east-west along the shoreline and north-south up the river valleys.

But, in a different context, "connected" refers to links with the waterfront's natural and cultural heritage. In the East

Industrial heritage: Pier 4 on Toronto's waterfront in 1948 (upper) and 1988 (lower)

Bayfront/Port Industrial Area, where the original natural habitats have been obliterated, we are reminded of the wealth of wildlife that once inhabited Ashbridge's Bay wetlands by the thousands of birds, butterflies, and other creatures that live, overwinter, and migrate on the north shore and the area's vacant lots. The previous recommendations on re-creating wetlands and redeveloping a connection with the Don Valley will help to restore a bit more of the natural heritage of the Don River/Lake Ontario interface.

As the Toronto Harbour Commissioners' report on *The Heritage of the Port Industrial District* points out, the area was the scene of important events and activities in Toronto's history. It concludes that:

> Industrial history is significant to our society. The physical evidence of that history, whether it be characteristic areas, buildings or other artifacts, deserves to be considered for conservation so that future generations will have a touchstone through which they can sense the past; to learn directly from it or simply to put their own efforts and their own lives into a larger human perspective.

As changes occur in the East Bayfront/Port Industrial Area, we can ensure historical continuity by incorporating elements of

the past in plans for the future. The use of a compatible scale and pattern in new structures will help maintain an appropriate sense of place. But doing so will require a change in attitude, from "general destruction with special exceptions" to a "general goal of retention with exceptions made for crucial new moves". The industrial landscape should evolve into whatever the future requires. All the existing pieces — roads, bridges, docks, channels, buildings, structures — can be treated with respect and, where possible, be used as the basis for future development.

Recognizing that change is inevitable, there are opportunities:

- to make a place with memory and depth, where buildings, patterns, and structures of all ages co-exist;
- to husband existing resources and re-use as many of them as possible;
- to recognize and reinforce important aspects of our history at the same time as we meet new needs;
- to create local places that are uniquely Toronto rather than ones that ape the international-anywhere style;
- to inform and entertain.

Recommendation:

28. Those individuals or agencies involved in future planning and design in the East Bayfront/Port Industrial Area should explore ways to keep as much as possible of the area's heritage. The study of *The Heritage of the Port Industrial District* suggests varied means to do this:

- **retain the land/water profile and permit respectful evolution of the patterns of road, rail, and services;**
- **retain major landmarks, chimneys, silos, pylons, and other structures that identify the district and provide evidence of its historic use and scale;**
- **transform industrial places sympathetically, whether open landscapes, streets or buildings;**
- **create a "museum" of Great Lakes shipping and Toronto's boating history composed of boats moored along dock walls;**
- **provide information in various forms;**
- **use historic names for streets, development areas, and buildings.**

Measuring Ecosystem Health

The environmental audit provides a good information base to use as a starting point for remediating and enhancing the East Bayfront/Port Industrial Area. However, the work undertaken by the technical groups revealed that, although there are many sources of information about the area, they are scattered and often difficult to synthesize because of inconsistencies in approach and methods. Members of the public also expressed frustration over the difficulty of gaining access to information held by different agencies. Clearly, there is a need for a centralized, publicly accessible, information base, not only for the East Bayfront/Port Industrial Area but for the Greater Toronto waterfront and watersheds.

The environmental audit team also found a lack of comprehensive approaches to measuring the health of the ecosystem, or its component systems (air, water, soils). Like

someone working on a jigsaw puzzle, there are many research programs under way in different departments at all levels of government, but no one of them is responsible for assembling the pieces into a whole picture, or for ensuring that no pieces are missing. Co-ordinated, comprehensive research, modelling, and monitoring programs would help to ensure that pathways in the ecosystem are explored, that cumulative effects can be assessed, that remedial programs can be evaluated, and that indicators of ecosystem health can be developed and applied.

The achievement and maintenance of ecosystem integrity — whether in the East Bayfront/Port Industrial Area or elsewhere — requires access to a comprehensive, balanced information system that can be used for research and communication; assessment and planning; and accountability, monitoring, and auditing.

Recommendation:

29. **A research and information network devoted to ecosystem studies in the Greater Toronto Bioregion should be developed. Key participants should include government departments (federal, provincial, and municipal), the Toronto Waterfront Regeneration Land Trust, the Canadian Waterfront Resource Centre, conservation authorities, universities and colleges, special programs like the Metro Toronto Remedial Action Plan, and non-government organizations.**

    The network would provide mechanisms to outline and co-ordinate a framework of research and monitoring programs intended to assist environmental management and decision-making in the bioregion. It would gather, analyse, and disseminate information on all aspects of the waterfront and watershed ecosystems. Information systems like RAISON (Regional Analysis by Intelligent Systems on a Microcomputer), GIS (Geographic Information Systems) and SERF (Socio-Economic Resource Framework) could be used to assist in analysis of relationships among environmental, social, and economic factors.

CONCLUSION

The environmental audit team has applied an ecosystem approach to a small part of the Toronto waterfront. It has gathered a considerable amount of information about the physical, natural, and heritage aspects of the ecosystem and analysed it (to the extent possible, given the limitations of the information) to reveal links among them and to assess ecosystem health. The result is a better understanding of the structure and function of the ecosystem: the different kinds of habitats and the plants and animals that use them; the many sources and loadings of contaminants to air, land, and water; and the possible effects of environmental pollution on wildlife and humans. It became obvious that there are serious problems requiring remediation, as well as special values worth protecting and enhancing.

The audit team deliberately focussed most of its attention on the physical and natural aspects of the ecosystem because these were identified as the most pressing issues, and because they could be addressed within limits of time and resources. The recommendations for the East Bayfront/Port Industrial Area in the *Watershed* report were made in light of the existing knowledge of the environmental audit. To learn more about the ecosystem, the social and economic aspects should be explored in more depth.

To the extent that the environmental audit has been a pioneering effort in applying an ecosystem approach, the audit team hopes its work will be useful to others. While it is relatively easy to collect information about different components of the ecosystem, it is clearly much more challenging to explore the links among them, particularly because most available information was not developed with that purpose in mind. The team's work demonstrates the need for new research and monitoring frameworks if use of an ecosystem approach is to be advanced.

Although there are — and, no doubt, always will be — gaps in our knowledge and understanding of the ecosystem, the audit gives a useful picture of conditions in the area as a basis for making decisions about its future. Specifically, the results of the environmental audit have suggested necessary action to restore ecosystem integrity. They include remedial and enhancement programs to:

- clean up contaminated air, land, and water;
- protect and increase wildlife diversity;
- improve habitat connections;
- maintain industrial heritage.

These opportunities should now be brought into the planning process for the area's future. Other elements of this planning process should include economic development, social needs, and decisions by different levels of government, based on full public consultation. When all these elements are in place, and the links among them understood, and when actions have been taken to restore and maintain their integrity, it might be said that a true ecosystem approach has been carried out.

Many demands will be placed on the East Bayfront/Port Industrial Area: it will be important to seek and maintain the appropriate balance between the natural, cultural, and economic components of the ecosystem. Through the democratic process — involving politicians, the public, bureaucrats, landowners, labour, developers, business, and non-government organizations — values can be expressed, needs stated, goals developed, and agreements negotiated.

In the context of the comments on stewardship and accountability in Chapter 4, it has become clear that existing regulatory and decision-making processes present a number of limitations to the ecosystem approach to planning and managing the East Bayfront/Port Industrial Area. Many of these issues require changes that are beyond the scope of the environmental audit; some are being addressed by ongoing work by the

Royal Commission, and by different levels of government.

The East Bayfront/Port Industrial Area presents a unique opportunity to put into practice the principles of ecosystem planning. Shabby, neglected and underused, yet strategically located minutes from downtown Toronto, the area needs a new direction for its future. The time is right for a vision that embraces ecosystem integrity — one that includes environmental, community, and economic health, and respects the needs of both present and future generations, of humans and of wildlife. We hope that *Pathways* will help to point the way towards defining that vision.

Port Industrial Area, close to the heart of the city

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Box 2: Rawson Academy of Aquatic Science. *Towards an ecosystem charter for the Great Lakes-St. Lawrence.* September 1989.

Box 3: International Joint Commission. Great Lakes Regional Office. *Revised Great Lakes Water Quality Agreement.* 1978.

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Figure 1: Toronto. Public Works and Environment Department.

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Figure 3: Hancock, T. *Towards healthy & sustainable communities: health, environment and economy at the local level.* November 1990.

Figure 4: Ontario. Metro Toronto Remedial Action Plan Office. *Metro Toronto Remedial Action Plan Newsletter.* 1989.

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Figure 9: Based on information collected by Sarah Kalff.

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Figure 12: International Air Quality Advisory Board as appears in *Great lakes, great legacy* by Theodora E. Colborn *et al.*, 1990.

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† ICCC (Inter-Ministry Committee on Clean-up Criteria) and MENVIQ (Ministère de l'Environnement du Québec) criteria were used where MOE (Ontario Ministry of the Environment) criteria were not available.

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